ENGINEERING NEWS

THE Texas State Capitol Board refuse to accept the building now that it is complete. The reason stated in the press is that it was not built in accordance with the terms of the contract, and that the copper roof leaks. Mr. E. E. MYERS, of Detroit, the architect for the capitol, says that he furnished plans, but that the Board selected a contractor against his advice and permitted this contractor to make many changes in the plan that have cheapened the work at the expense of durability and stability. Among other things they entirely omitted a very elaborate and complete system of sewerage, and substituted thin galvanized for cast iron in the dome.

ALL the telegraph poles along the west side of Sixth Avenue in this city, from 35th to 50th St., have been removed and the wires put into the subways. The avenue looks much wider than before and the remaining poles are to be removed as speedily as possible.

THE HUNT frescoes on the walls of the Assembly chamber in the capitol at Albany will be ruined in the repairs now going on; holes are being cut through them to admit the trusses for the new ceiling. It had been originally proposed to paint these pictures on sheet-lead secured to the stone, but Mr. HUNT objected to this arrangement unfortunately. As it is $15,000 have been wasted.

M. DE LESSEPS is still confident, and still does not hesitate to put himself on record as promising impossibilities. A paper written by him read before the British Association at Bath on Sept. 6, declares that he is confident of completing the Panama Canal with ten locks on each side by 1890, if we understand the somewhat vague telegrams correctly. It is to the last degree improbable, however, that even ten locks on one side will be in complete working order by that date. Meantime, little is doing on the excavation and the Chagres flows on unchecked.

THE new signal station at Elizabethport on the line of the New Jersey Central will be opened Sunday, Sept. 16. It is the largest in the vicinity of New York, with the single exception of the Grand Central Depot.

FOUR CAR TRAINS have begun running on the Brooklyn Bridge this week, after a delay of nearly a year from the time first announced for running them, October last. They are now running on about 100 seconds headway or 144 cars per hour against 120 cars with 3 car trains at 90 seconds headway, or 135 cars per hour with 3 car trains at 80 seconds headway, as they have been at times running. Two switching engines are used at each end, taking hold of the trains alternately, the apparent purpose being merely to relieve one crew of excessive duty, since no time is saved thereby, as some of the newspapers have stated, while there is an additional backward trip and switch to be made by each engine. The traffic has ceased to increase much, as is inevitable from the fact that the reasonable limit of capacity was long since reached, and the growth is thrown upon the ferries. The daily traffic receipts for August were, 1886, $1,687; 1887, $1,926; 1888, $2,029.

THE Chicago, Burlington & Quincy Railroad is said to be experimenting with the "Rodger's ballast-car and spreader" in its freight yards at Hawthorne. This is a car very much like an ordinary hopper-car, but has a capacity, of 50,000 lbs. The hopper runs the length of the car and extends to within 1 ft. of the track, and it is opened and the fall of the stone controlled by levers. The "Spreader" is a steel plow fastened under the body of a flat car and reaching below and on both sides of the rails. The car travels at the rate of 3 miles per hour, and in the trial 20 tons of ballast were spread along a new track in about 1 minute.

THOSE "Yankees of South America," the natives of Chili, seem to thoroughly understand the art of piling up revenue, for with a population of only about 3,000,000, this country estimates its income for 1888 at $36,000,000, with an $8,000,000 surplus to its credit from last year. In 1886 its revenue was $9,000,000 and in 1877 it was a little less than $17,000,000. Its foreign indebtedness is $34,000,000, recently funded by the Rothschilds at 4½ per cent interest.

THE worst railway accident of the week was another circus train disaster. A long 35 car train, ended by a caboose and 5 sleepers (probably of the light emigrant type), had left Xenia, O., at midnight after a performance. At 2:30 A. M. its rear was run into, while in the very act of stopping at a water-tank to take water, by a heavy freight train. Fortunately, train-master AIKEN, of the circus, was standing at the side of the train and saw the headlight of the approaching train "flash around the curve, less than 1000 ft. off". With a promptitude and self sacrifice which does him the greatest honor, he jumped on the cars and ran through the three rear sleepers, all crowded, awakening the sleepers so quickly and effectually, that all the occupants escaped, thus saving a frightful slaughter, and after shouting into the fourth car jumped at the instant of collision. A flag was dropped off the circus train, but the other was following too close to have it do any good.

WHAT then happened was: The caboose was split in two and fell over to each side. Sleeper 1 telescoped sleeper 2, and that in turn sleeper 3, but all these were empty. Sleeper 4 (full of people) then telescoped sleeper 5, and in this all the injury was done: 4 killed and 18 injured, with "many others" more or less hurt, out of perhaps 30 or 40 in the car. The cause of the accident is said to be "the extreme carelessness of the trainmen, but whether both crews are to blame or only one, and if one crew, which one, has not been settled." It is apparent that the rear train was primarily to blame in not keeping a proper distance in the rear, but the true blame in most of these very numerous cases of accidents to special trains lies back of the crews in the general system of administration This accident was another of the very numerous cases, likewise, in which train brakes and close couplers would have saved all disaster.

ANOTHER serious railway accident of the week was a rear collision on the New York, Pensylvania & Ohio, near Wadsworth, O., Sept. 10. Train No. 5 was divided into five sections, the 30 cars of which were filled mostly with excursionists going to attend the Centennial Exposition at Columbus. Section 4, having 13 cars, had just passed River Styx Station, near Wadsworth, when a driving rod of the locomotive broke and the train was stopped. Trainmen were sent back to flag a freight which was following, but they were unable to prevent a disastrous collision. The heavy train, instead of being 10 minutes behind according to rules, was only 5 minutes and going at a high rate of speed down a 50 ft. grade, plunged into the rear of the excursion train. Four cars were wrecked, two of them being completely demolished. All the excursionists succeeded in getting out of the cars before the crash came, but as they hurried down the slope of the embankment upon which their train was standing the wrecked cars followed them. Three persons were killed outright, two fatally hurt, and twenty more injured. The responsibility rests with the engineer and conductor of the freight train, that train being 5 minutes ahead of its time.——On Aug. 31 a broken axle caused a freight car on the Northern Pacific to jump the track as the train approached a trestle near Spokane Falls, Wash. Ter., but the train passed the trestle in safety. Three cars were smashed and one man was killed.

DURING the week there have been serious floods in the South and in Mexico. The Savannah river flooded Augusta, Ga., and several mills along the river were stopped by high water. In Virginia the heavy rains have damaged the crops. At Augusta the water reached the highest point of any flood and great damage has been done; the injury to the canal will amount to $200,000, Other places in Georgia have suffered severely. Washouts have occurred on the Carolina, Knoxville & Western, Columbia & Greenville, Richmond & Danville, Danville & New River and Cape Fear & Yadkin Valley railways. On the Norfolk & Western a passenger train was wrecked at a landslide. In Mexico the most serious results of the storms and floods have been in the State of Vera Cruz. Several washouts have occurred on the Mexican Railway and several bridges on that line, have been wrecked. A tunnel has also caved in. The recent cyclone did considerable damage at the port of Vera Cruz.

THE following bridge accidents are reported: On Sept. 6 the iron bridge of the Chesapeake & Ohio R. R. over the New river at Grand View, W. Va., was washed away, involving a loss of $50,000.——On Sept. 6 two bridges were wrecked by flood near Chester, S. C.——On Sept. 9 the highway and railway bridge over the Muskegon river at Newaygo, Mich., were washed away by a flood caused by the giving way of a mill dam. New iron bridges will be built.——Some runaway flat cars, loaded with rails, on the Wickes branch of the Northern Pacific, wrecked the bridge over the Prickly Pear river at the Prickly Pear junction. —— The trestle near Reidsville, N. C., on the Richmond & Danville, has been washed out and several bridges in Georgia have been more or less damaged by the floods.—— The Blue Tent railway bridge, 6 miles north of Red Bluff, Cal., has been partly destroyed by fire.—— The Columbia & Greenville Ry. trestle over Ninety-Six creek, near Ninety-Six, S. C., has been washed out.——On Sept. 9 a trestle in course of construction for the Eastside Railway, at Newport, Ky., collapsed owing to a team of mules becoming entangled in the guy ropes and hauling away some of the timbers. Two men were killed.——On the Mexican Railway three spans of the big iron bridge at Barranca have fallen, the structure having been injured by the floods.

THE premature explosion of a blast in the south face of the Wickes tunnel of the Montana Central Railway, south of Helena, on Sept. 11, killed 10 men and seriously wounded 5 others. The accident was caused by the concussion of a cap fired as a warning in the north face, the headings being now close together. This is the first casualty recorded in the tunnel, which is over a mile in length.

THE famous Metlac bridge on the Mexican (Vera Cruz) Railway, across the Metlac *barranca* or gorge has succumbed to adverse circumstances three of the 50 ft. spans, or one-third of the bridge, having fallen as an effect of the late tremendous storm. The bridge is only some 90 ft. high and would not be regarded to-day as a very great structure, but it was almost the first of the modern type of iron trestles. The piers are a cluster of 9 cast-iron columns founded on low masonry piers. Whether the failure came from under-mining of the piers or from injury to the cast-iron piers by the water rising above the masonry does not appear. Probably the latter was the case. The bridge is on a sharp horse-shoe curve 325 ft. radius, and is flanked at each end by a tunnel, one of which is said to be in danger of caving in. It is stated, and perhaps with truth, that travel will be interrupted "for several weeks, while a provisional structure is being built."

LATER REPORTS are that the entire bridge has gone out, with various other minor structures, and that two or three weeks will be required to get the line open again by a temporary structure.

CORPORATION COUNSEL BEEKMAN, in answer to a query put by Gen. DUANE, President of the New Croton Aqueduct Commission, concerning the payment of aqueduct laborers by "store orders" says: "Section 1 of the contracts provide, among other things, 'that the said party of the second part will punctually pay the workmen who shall be employed upon the aforesaid work in cash current, and not in what is denominated as store pay.'" He advises the board to call the attention of the offending contractors to this provision of their contracts.

A CORRESPONDENT, of the Baltimore *Sun* says, in reference to the late accident at the draw of the Balt. & Ohio R. R. bridge over the Schuylkill river in Philadelphia, that the testimony shows that the signal apparatus had been disabled for the previous 5 weeks by a broken wheel. Repairs had been planned but were delayed, and the engineer and fireman on the engine mistook a white light at the other end of the bridge for a safety signal. The engineer on the draw claims that the bridge watch man waved a red danger light signal.

The Croton Dam Gate-House of the New Aqueduct for New York City.

The Croton Dam gate-house for the new aqueduct, shown in this issue by plan and a progress sketch from a photograph, is one of the largest, if not the largest, similar structure in the world. The close proximity of the old Croton aqueduct, upon which a great city was depending for its sole water supply, and the untold damage that might result from any interference with this supply, influenced in a great degree the plan adopted. After careful study the engineers of the aqueduct decided that as the main conduit was in a tunnel it was best to bury the gate also, at the expense of some very heavy work; and in so doing they have provided against all contingencies of trouble with the old conduit and most successfully met the somewhat difficult conditions of the problem.

Referring to Fig. 1, the gate-house location may be described as follows; First, arrangements had to be made both for utilizing the new aqueduct before the completion of the Quaker Bridge dam and after this structure was finished, dealing in the interval with widely different heads of water in the old and the proposed new dam; for the present Croton dam is at an elevation 166.93 and in the new Quaker Bridge dam, the flow line will be at an elevation of 206. As the old aqueduct lies between the Croton river and the new gate-house, the first supply will be taken in by the by-pass (Fig. 1.) which leaves the Croton Lake at a point above the present inlet, with a diameter of 14 ft. and an invert elevation of 140 ft. above datum. This by-pass goes around the old conduit and enters the gate house at the point indicated by the arch-centering to the left in Fig. 2. By it the water will enter the gate chambers and circulating through them it will enter the new aqueduct on its way to New York by the opening shown to the right of the one first mentioned in Fig. 2. At the same time a conduit 8½ ft. in diameter will be built towards the old aqueduct but not connected with it, as shown on Fig. 1.

Preparations will also be made to connect this gate house with the new lake, by a surface inlet entering just over the by-pass inlet with an invert elevation of 184.5, and a bottom and middle inlet leading straight from the river (with inlet elevations of 140 and 166) but not touching the ground occupied by the old Croton aqueduct.

After a water supply has been turned on through the new aqueduct leading to New York and all appliances have been tested beyond doubt of failure, the connection with the old aqueduct will be completed, and also that with the surface, middle and bottom inlets before referred to. At this time it is to be supposed that the new dam at the Quaker Bridge is in service and that the present Croton Dam gate-house and the portion of the old aqueduct just before the new gate-house, is flooded out and useless, and will oe removed.

By connecting the old aqueduct with the new lake at a point near the Quaker Bridge Dam, the new gate-house and aqueduct can be supplied with water from the dam, 4 miles below the gate-house—in case this should be desirable. This supply is rendered possible by the difference in head between the new aqueduct entrance in the gate-house, which is at 153, and the head of 206 in the new lake; with this extra head the 8½ ft. opening can be made to supply the new 14 ft. aqueduct with sufficient water. The advantages of this arrangement are in creating a circulation in the lake and in thus demolishing the theory of certain opponents of the Quaker Bridge dam that this 4 miles will be always dead water. A Y-connection at the dam will permit the old aqueduct to also furnish at the same time its due proportion of the general water supply.

To properly decribe the interior arrangement of this gate-house would require a number of sectional views. But for the present it will suffice to say that it is so arranged as to have any of its chambers under control for emptying in case of repair to gates etc., or in meeting any of the several conditions accompanying the use of this structure. Instead of using the cheaper ordinary 4 ft. gate, the engineers have decided upon a number of rectangular openings, so that under all states of head or pressure there will be no reduction in the volume of water passing. This arrangement makes necessary rather a formidable battery of gates under great pressure; but these will be manipulated by hydraulic power obtained through a turbine set in the well opening shown. The central well hole communicates by pipes with each of the several chambers, and this well in turn is connected with the larger one shown; by a centrifugal pump (at elev. 155) in the large well, discharging into the aqueduct, the chambers can be practically made dry for inspection or repair.

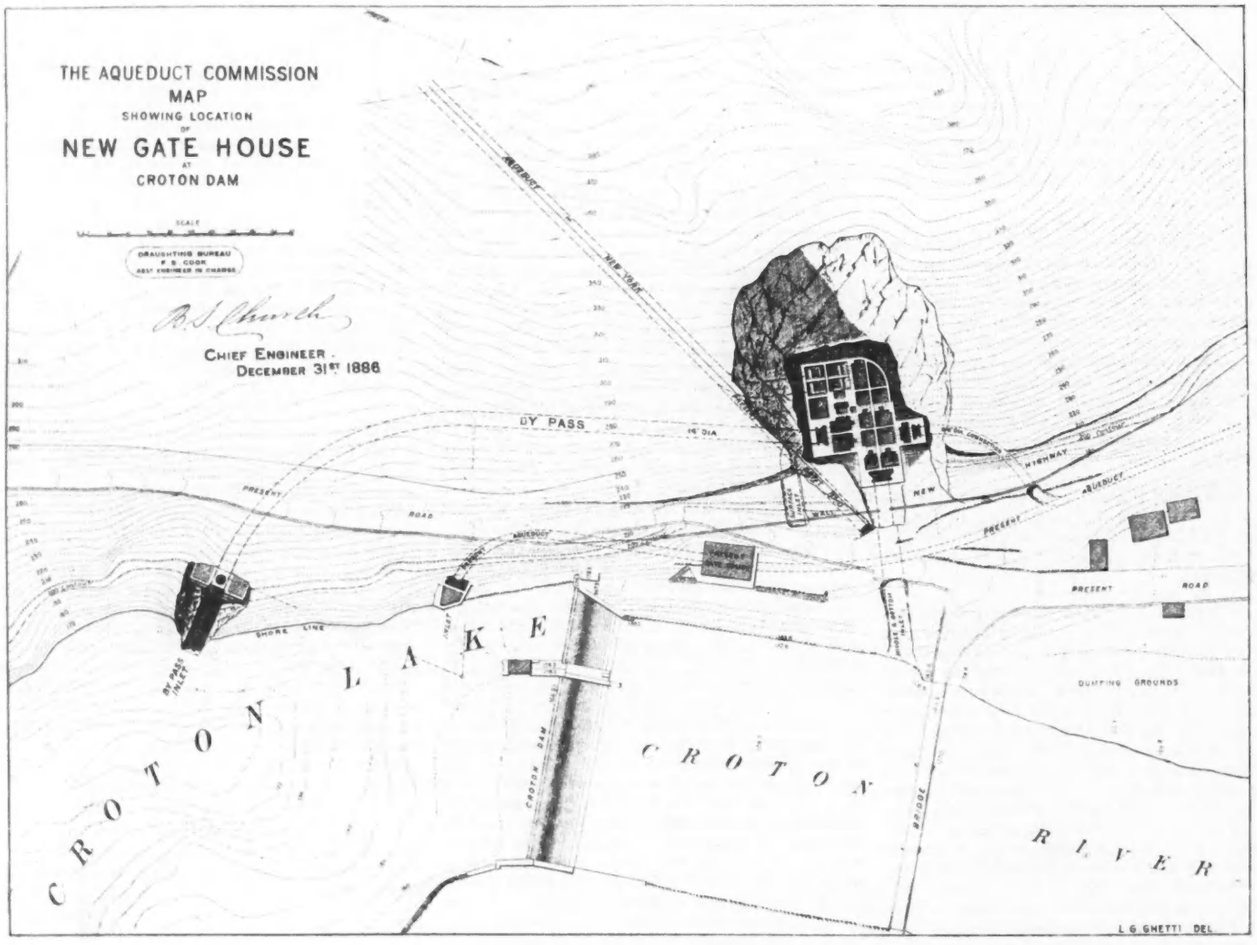


Fig. 1. Location of Croton Dam Gate-House.

The contract for this gate-house was let on Aug. 4, 1885, to Messrs. J. S. SMITH and H. H. BROWN, who later associated with them Mr. M. S. COLEMAN. The contract price was $442,750, not including the superstructure or the gate machinery.

THE most flattering reports come in respect to the recent gold discoveries along the Lake Superior coast of Michigan. The details may be exaggerated but there seems no doubt that the mines are to prove very valuable.

A METHOD of tinning by simple immersion is described by *L' Echo des Mines et Metallurgie*. Argentine, it says, is a name given to tin precipitated by galvanic action from its solution. The material is usually obtained by immersing plates of zinc in a solution of tin containing 6 grammes—about 90 grains—of the metal to the litre—0.88 quart. In this way tin scrap can be utilized. To apply the argentine a bath is prepared from argentine and

acid tartrate of potash rendered soluble by boric acid. Pyrophosphate of soda, chloride of ammonium, or caustic soda may be substituted for the acid tartrate. The bath being prepared, the objects to be coated are plunged therein, first having been suitably pickled and scoured. They may be subjected to the action of an electric current, but a simple immersion is enough. The bath for this must be brought to ebullition, and objects of copper or brass, or coated therewith, may be immersed in it.

Standard Measures.*

BY E. A. GIESELER, C. E.

(*Concluded from Page 183*)

Line measures are compared by means of microscopes. Two of these, furnishe dwith micrometers, are arranged as a beam compass, in such a way that the measure resting on its support can conveniently and exactly be moved into their focus. After the cross-hairs have been brought to coincidence first with the lines of the standard measure, the reading of the micrometers is taken and then the measure to be compared is introduced in the place of the standard and treated the same way. The difference between the two micrometer readings then renders the difference in length between the two measures. An apparatus of this kind in use at the Coast Survey building in Washington is arranged so that the bars are enclosed in a glass case during the comparison, the shifting and placing of them being done from the outside by ingeniously arranged levers, so as to avoid the influence of the heat emanating from the observer's body.

It is scarcely necessary to add that the successful handling of such instruments requires great experience and skill. To arrive at results as close as the small limits mentioned before is an exceedingly difficult and laborious process, during which numerous sources of error have to be carefully guarded against and which has to be repeated many times before the result is looked upon as well established. In this connection and in illustration of the great difficulties incident on the work of comparing length measures, some remarks may be quoted, made by Prof. HILGARD, late Superintendent of the Coast Survey, an acknowledged and widely-known authority. In the Coast Survey Report of 1876, he expresses himself as follows on the comparisons between the British Imperial and the American Standards:

"Extreme accuracy in this matter is beset with great difficulties, for in addition to that of ascertaining for each particular bar the rate of dilatation by temperature, there is an uncertainty in regard to permanence in the length of the bars themselves. The two standard yards presented to the United States, one is of bronze (No. 11) and the other of Low Moor wrought-iron (No. 57) are found to have changed their relative length by 0.00025 in. in 25 years; the bronze bar being now relatively shorter by that amount."

In further discussion of this remarkable fact, Prof. HILGARD says in the report of 1877:

"When we consider the constitution of any bronze metal, especially such as BAILEY'S metal, from which, on account of its great rigidity, the British bronze standards were made, and which consists of copper, 16 parts; tin, 2½ parts; zinc, 1 part; we will observe the fact that about ⅞ of the mass is composed of copper, a very pliable and ductile metal, while the admixtures have imparted to it great hardness and rigidity. This alloy was especially selected for the latter mechanical qualities, but the suitability of the molecular structure was not considered. In the light of our recent experience, we are permitted to assume, that the molecules of such a casting are in a state of great tension, which will yield under changes of temperature, and, if so, perhaps in less degree, to the simple effect of continuance. Hence while we admit that the shortening of No. 11 bronze relative to the Imperial Standard has taken place in consequence of the great variations of temperature to which it has been subjected, it is not improbable that No. 1 and No. 6 (British bronze standards) may both have shortened by the effect of time alone during the past 20 years, so as to make the excess of No. 57 (wrought-iron) a reality rather than an accumulation of residual errors."

Having now discussed in a cursory way the history of standard long measures, as well as various methods of their construction and comparison, it remains finally to inquire into the practical application of all this in our own particular case; that is, to cast a glance at the ways pursued in adopting and introducing a uniform measure of length in the United States.

A stranger, unacquainted with the subject and seeking information on the same, would naturally turn to any of the manifold and well-known handbooks containing formulæ, tables and other information daily needed by the engineer. Suppose, now, he would first chance upon HASWELL, "Mechanics' and Engineers' Pocket-Book," edition of 1887, then he would there find upon page 44 the following information:

"English Imperial Standard is referred to a natural standard, which is a pendulum 39.1393 ins. in length, vibrating seconds in vacuo in London at level of sea, measured between two marks on a brass rod at temperature 63°.

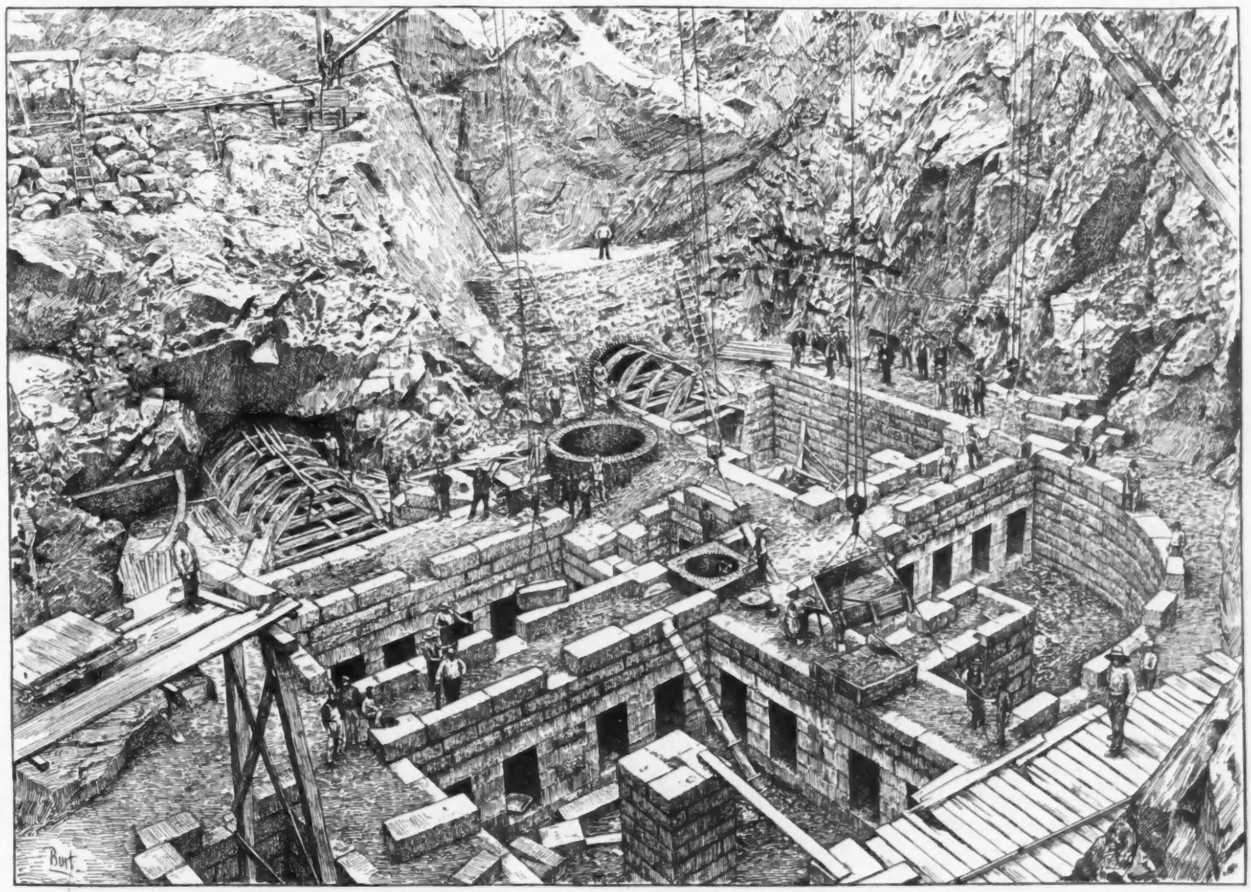


Fig. 2. Progress View of Croton Dam Gate-House; (from a photograph.)

"Note.—In consequence of destruction of Standard by fire in 1834 and difficulty of replacing it by measurement of a pendulum, the present Standard is held to be about 1 part in 17230 less than that of the United States, equal to 3.67 ins. in a mile."

Suppose that, not being satisfied with one authority, he consults a second one, and this time happens to select TRAUTWINE'S "Engineers' Pocket-Book," edition of 1887, then he will there read to his astonishment:

"By law, the United States Standards of length are made the same as the British."

Not being able to harmonize these two statements he concludes to fall back upon an English authority, and chooses D. K. CLARK'S "Manual of Rules, Tables, etc.," London, 1884, where on page 186 he finds:

"United States. Length. The measurements are the same as those of Great Britian."

Suppose that our inquisitive foreigner now concludes to inquire for the actual standard and, being in New York, is shown to City Hall. There, on the north wall of the western corridor, at a height of

about 5 ft. from the ground, he will find two lengths of 10 ft. each, marked on the wall, one of them designated as English and the other as Amsterdam measurement. Above them are the words: "Federal measurement," with a blank space opposite left for the purpose of marking the length. Although this has not been done yet, the setting apart for it of a space at the side of the English standard is certainly strong evidence of the fact that the two measures were considered different.

The matter now stands two against two, and our inquisitive friend will probably give up his hunt for the American standard, being afraid that further investigation might involve him in further doubts.

As a matter of fact, the English author's statement is the only correct one, while the writer is sorry to say that our two countymen are in error. American measure is not any longer than English measure, as HASWELL states, but it is precisely the same. Yet it is not so by law, as TRAUTWINE states, because, unfortunately, Congress has never passed a law to this effect. The salient historical points in this question may be summed up about as follows:

The standard yard of Great Britian was lawful in the Colonies before 1776. By the Constitution of the United States, Congress was empowered to fix the standards of weights and measures; it has, however, not made any use of this power as far as length measures are concerned, the only bills ever enacted on this subject being the following two: One approved of June 14, 1836, and empowering the Secretary of the Treasury to distribute complete sets of weights and measures to the different States, and one approved of July 28, 1866, legalizing the use of the metric system.

No new standard of length having been created by Congress to take the place of the old Colonial, that is, the British standard, this latter simply held over. The Coast Survey, in order to have a well accredited copy of it, procured the TROUGHTON scale, and on the strength of Mr. HASSLER'S investigation, pronounced a certain part of it to be a standard at 62° F. When the comparsion with the British government standards, received in 1856, had shown the Troughton scale to be too long at this temperature, then its standard temperature was accordingly corrected to 59°.4 F. On the strength of subsequent comparisons, made about 1874, by Mr. HILGARD, at the British Standard's office, the standard temperature of the TROUGHTON scale was once more changed to 59°.8 F., and after still further comparisons it is given in the Coast Survey Report of 1877, page 181, at 59°.62 F., at which temperature the yard contained between the twenty-seventh and the sixty-third inch of the TROUGHTON scale is so far finally stated to be exactly equal in length to the British Imperial Standard.

It is quite evident from all this that the intention has always been to entirely and precisely conform our measure to the English measure, and that the acquistion of the TROUGHTON scale, and the adoption of a part of it as a standard simply were steps towards this end, steps which were modified as soon as they were found not to have exactly led to the object in view. But the comparisons leading to these modifications were only commenced after the TROUGHTON scale had existed for many years as the undisputed American standard, so that its character, as such, had become so firmly rooted in the public mind, that the difference found between it and the British government standard, appears to have been looked upon by many as a difference between American and English measurement. This at least, in connection with the destruction of the British Standard by fire, in 1834, and the difficulties incident on its exact reproduction, seems to be a probable explanation of the origin of an erroneous statement of facts, which, as we have seen, has even found its way into the best books of reference. There can be no doubt, that all uncertainties and misunderstandings in the premises would have been prevented, and a perfectly clear and definite knowledge would prevail everywhere, if this important matter had been dealt with, as in other countries, by an explicit act of the legislative body, and it is to be regretted that this has never been done.

Such action, if it had included proper provision enabling private parties to obtain correct measurement, would have been exceedingly beneficial, especially to that large class of professional men for whom an accurate and trustworthy length-measure is amongst the most important every-day needs. At present, the engineer, for instance, desiring to test the length of his steel tape, has to be exceedingly careful not to be deluded by so-called standards, that are worthless notwithstanding a certain show of authenticity.

In the writer's own recent experience, he found three public standards in New York and Brooklyn at variance amongst each other so much as to make it unsafe to trust to any of them. In the very metropolis of this continent there was, therefore, no reliable official way of obtaining correct measurement, and the writer was compelled to address himself to the Coast Survey at Washington for this purpose.

The Manufacture of Valves and Hydrants.

Probably very few of our water-works readers have any clear notion of the processes by which the raw materials are worked up into the above named articles, and through the courtesy of one of the leading establishments in this line of manufacturing, we are enabled to present the following detailed account of the various steps by which pig iron, tin, copper, lead and antimony are shaped into the ordinary water gate, the fire hydrant or the less common forms of gates for ammonia, acid and extra heavy pressure in any line.

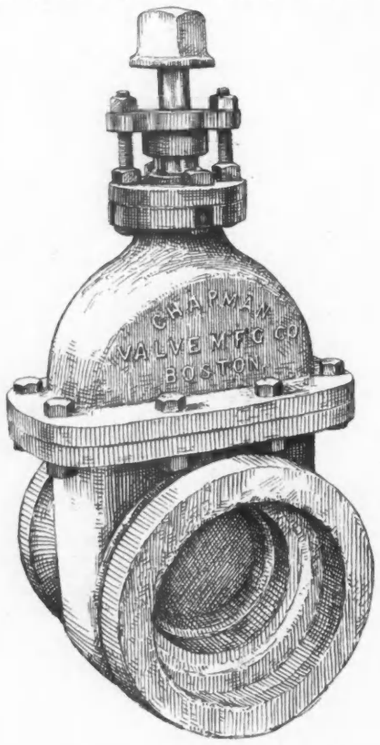


Fig. 1.

The foundries seem to be the starting point in any heavy establishment, and turning our attention to this part of the plant we shall watch the raw material receive its first definite shape. The casting of so well known and simple a piece as the body of an ordinary water gate (Fig. 1) requires the use of a pattern, a core, a flask, a core box, molding sand, core sand and a skillful moulder with his special tools. The patterns for any piece of work often appear to be in some ways strangely unlike the casting to be produced. For example the pattern for an ordinary bell end water or gas gate body, Fig 2, has projections where the gate has a bell or hub and a similar projection at the top where the finished casting has an opening into the body. These projections are called "core prints" and serve to keep both the pattern and the core in place. The relation of core and pattern is the most difficult and interesting phase of the art of founding. We have all heard it said that to make a cannon one has only to take a hole and pour some iron about it, and senseless though the expression be, taken literally, it points in the right direction.

Fig. 2.

If we were to take, for example, a wooden pattern whose outward shape would exactly correspond to that of the gate in Fig. 1, and after moulding it in sand or plaster should withdraw the pattern and fill the mould with molten metal, we should get a casting of the proper shape outwardly, but it would in fact be only a useless mass of *solid* metal, and we want our gate to be *hollow*, like the war ship of that astute Secretary of the Navy with whom Americans are familiar.

To secure this hollowness is the office of the core. A core therefore is a solid body of core sand, whose *outside* shape exactly corresponds to the form which we desire to give to the *inside* of our casting. In any but the simplest work, cores are usually built up of several pieces fitting each other so closely that no metal will run between the joints.

A pattern then, gives shape to the outside of a casting; by being buried in a box of sand called a flask and having the sand thoroughly packed about it. Both flask and pattern are made in halves so that the pattern can be drawn without disturbing the impression in the sand. Fig. 3 shows the core for the body of a bell-end water gate, and this core is placed in the middle of the impression made in the sand by the pattern. The core does not quite fill the impression and it is the space about this core which is filled by the molten metal, the width of this space being equal to the thickness of the casting. In order to support the core and to provide opportunity for the metal to run into the space provided for it, extra pieces and bunches are often cast which have to be cut away before the casting is ready for the machine shop.

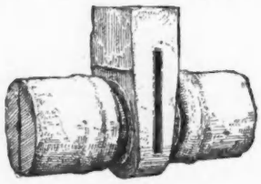


Fig. 3.

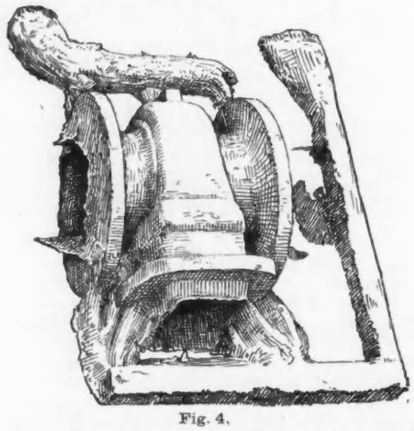


Fig. 4.

For example, in Fig. 4 we see how a six-inch composition flange gate body appears as it is broken out of the flask, and we note two or three excrescences that those who buy the finished product never see.

These appendages to this casting exist because a careful founder likes to have the liquid metal enter the mold at the bottom, rise slowly up through the space left for it and finally overflow at the top. This method avoids any chance for injury to the mold by having the metal fall into it, and gives any dross a chance to escape, and leaves the casting sound. In order to get the metal in at the bottom of the mold special passages are provided in the sand,

and these passages being full of metal when the pouring is completed, the metal therein solidifies and appears attached to the casting when the mold is broken open.

A pattern can be used over and over again until it is worn out or damaged, but it is evident that a core is bottled up inside of the casting in nine cases out of ten and must be broken up to get it out of the way. In the establishment under description about fifteen men and boys are kept constantly employed in core making, and the materials employed are coarse sand, rye meal, or some other glutinous substance, mixed with water or molasses and water, and a refuse liquor from breweries called still-house returns. The making of cores for small valves, *i.e.* two or three inches in diameter and less, is a very simple matter, and is done by boys, who press the mixture of sand and meal into an iron core box made in halves, ram the sand vigorously, open the box and the core stands alone. It is not ready for use, however, until it is baked, and it requires very

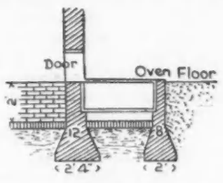


Fig. 5.

careful handling lest it fall in pieces like the mud figures which these same boys made in sport, perhaps not many years ago.

The making of a core for a 30-in. water gate is, however, no "boys' work". This is a large piece to build up out of such porous material as the sand and meal mixture; but porosity must be had in the core to allow for the free movement of the gases which are generated when the molten iron enters the mould. In a core of this size, or in a long core for a hydrant barrel, a skeleton of iron or an iron rod makes the foundation upon which the core is built. Sometimes old files are stuck through the mass in every direction and so serve to bind the core together. After the core sand has been well packed, the boxes are removed and the core is sprinkled through a common garden hose and sprinkler nozzle with "still-house returns", which is kept in a hogshead standing on a platform about 15 ft. above the foundry floor.

After this treatment the core is run into the core oven on a truck and baked until it is well hardened. It can then, by careful handling, be made to do its work. The placing of the core in the mould is an important detail, for unless it is truly placed and firmly held a casting of uneven thickness will be the result. We noted special care in this matter in the works under description, as shown in the iron flasks wherein the core is held by a turned opening in the

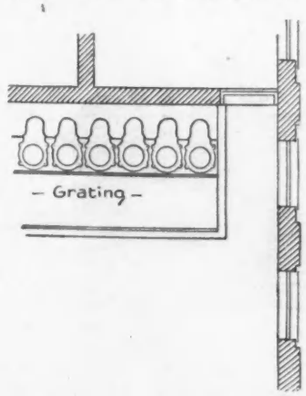


Fig. 6.

flask itself, in large core prints, in the patterns into which the ends of the core exactly fitted, and in the center support given to long cylindrical cores to prevent any tendency to sagging in the middle. The core oven is nothing but a brick chamber, either rectangular or circular, heated by a coal fire built in a fire pot set below the floor as indicated in Fig. 5.

"Pouring off" in the foundry comes about four o'clock in the afternoon. The iron is melted in a furnace called a cupola, which is nothing but a wrought-iron shell lined with fire clay, having openings in the sides and the bottom which are connected with a powerful air blower, and standing on iron posts about 3 ft. above the foundry floor. A fire is built early in the afternoon and alternate layers of coke and pig iron are put into the furnace through a door in the side on a level with a raised platform, perhaps 12 ft. above the foundry floor.

Heating of the charge goes on by natural draft until about 3:30 p. m., at which time "the blast" is let on and the melting begins in earnest.

A great deal of sand adheres to the castings the greater part of which is removed by soaking the castings in hot diluted oil of vitriol for 48 hours, and then washing them thoroughly with clear water. This treatment with acid is called "pickling". In special cases the faces of the mould are covered with a wash of black lead which does not adhere to the iron, and the pickling of such castings is not necessary.

The foregoing statements refer more especially to the iron foundry. Composition castings are not "pickled". The sand does not adhere so firmly to the brass, and by pouring cold water on the hot castings it is easily loosened. The sand is removed from the smaller brass castings by putting them into a revolving cylinder about 3 ft. in diameter and 4 ft.

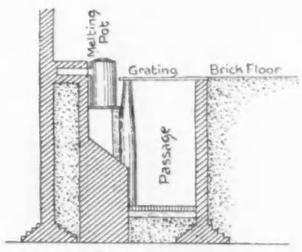


Fig. 7.

long, and with them the skimmings from the melting pots containing the molten brass. These skimmings are largely of good metal, but are covered with sand and dirt. The castings and skimmings are tumbled over and over and against each other by the revolution of the cylinder. Water is freely introduced through the trunnions of the cylinder and

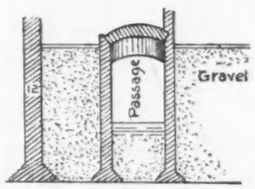


Fig. 8.

washes away the same from both the castings and the skimmings; even this sand contains enough metal to make it worth one cent a pound for washing again. The tumbling process is followed, too, in cleaning small iron castings, but no water is used and the dumpings of the iron cupolas take the place of the skimmings from the melting pots. The amount of metal saved by these processes is surprising to one who examines the results for the first time. With meltings of 7 or 8 tons of pig iron daily, from 300 to 500 lbs. of iron fit for remelting are obtained from the tumblers or rattlers.

The arrangement of the melting furnaces in the brass foundry is exceedingly convenient, and is illustrated in Figs. 6 and 7. No ashes are lifted on to the foundry floor, but are removed through a subterranean passage leading by an incline to the surface of the yard, Fig. 8. The grates of the furnaces drop by swinging on hinges at the back, thus throwing the ashes on to the inclined surface directly under the furnace where they are easily taken care of.

Some notion of the great variety in the wants of consumers may be formed by an inspection of the fireproof brick pattern house wherein is stored a bewildering assortment of patterns made of iron, of wood and of brass, and which is valued at not less than $50,000.

In the iron foundry are used the No. 1 and No. 2 pig iron, and a small percentage of first-class scrap—the chief end being the production of strong, dense and clean castings. In the brass foundry no ordinary yellow brass mixtur's are used; but for valve spindles, for example, the proportions are 9 lbs. of pig tin to 70 lbs. of copper with a little zinc

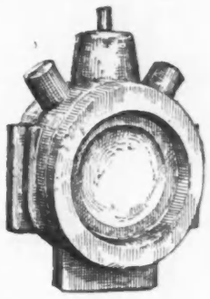


Fig. 9.

Fig. 10.

and lead. The plug or gate proper in the valves made by the establishment under consideration is all in one piece, and though for the purpose of distinguishing it from other forms it is spoken of as a solid plug, it is, to secure lightness and economy of metal, made hollow with strengthening bars connecting the walls. Fig. 9 shows the plug pattern and Fig. 10 its core for an ordinary water gate.

In small composition valves the wedge-shaped plug is of solid composition, but in the larger gates the plug is of cast-iron with a dove-tailed annular space on each side into which a ring of composition is poured to form the face of the valve. Before receiving this composition ring the cast-iron plug is heated by contact with red hot weights, and the thickness of the ring varies from $\frac{1}{8}$ to $\frac{1}{4}$ in. according to the size of the gate. Before this ring is faced it is thoroughly hammered to insure the complete filling of the dove tails, and all chance of any loosening is destroyed.

Fig. 11.

Fig. 12.

After the plug has been on the machine and the valve body has been made ready, the plug is dropped into its place in the body, all outlets are properly closed and the seats of the valve are formed by pouring in a composition which resembles Babbitt metal. An absolutely perfect fit between faces and seats is obtained by this method, no machine work upon the surface of the seats is required, and dovetailing is resorted to in the body as in the plug to hold the composition firmly in place.

The special methods by which this process of making the seats is carried out are ingenious, interesting and the result of patient experiment and long experience. The exact composition of the ma-

terial of the seats depends upon the uses to which the valve is to be put and the different varieties are distinguished in the works by the names, water metal, steam metal, gas metal. In Fig. 11, we have

Fig. 13,

the pattern, and in Fig. 12 the principal part of the core for making the post of an ordinary hydrant,

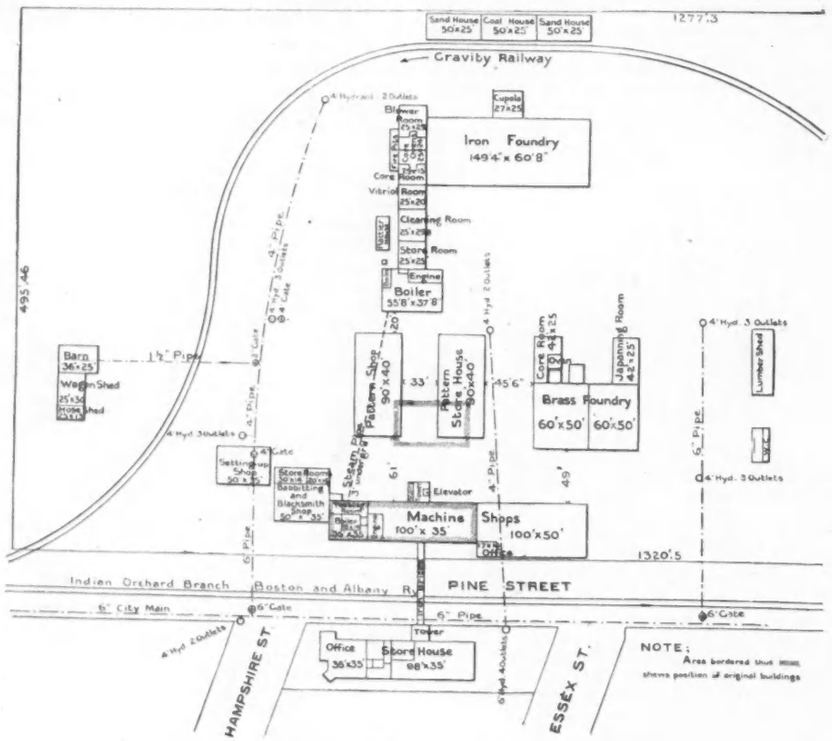


Fig. 14.—General Plan of the Works of the Chapman Valve Mfg. Co.

and in Fig. 13 a flask of tops belonging to 1½ in. composition valves.

In contrast with many manufacturing concerns, the shops of the Chapman Valve Mfg Co., which we have taken as our text, are attractive in external appearances and full of light and cheerfulness within. Brick is the material for all but temporary structures, and red mortar, black markings and some architectural skill in planning cornices and arranging windows have secured excellent results.

A general plan of the works is given in Fig. 14, and a feature of special interest is found in the railroad facilities afforded by the location of the factory between the main line of the B. & A. R. R. on the south, and the Springfield and Athol branch of the same road on the north, together with the fact that grade descends from the main line to the Athol branch so that cars starting on the siding at the main line will descend by gravity to the works where they can be unloaded if full and loaded if empty, with the finished product, and in both cases carried on to the Athol branch where engines pull them to Springfield.

This general plan Fig. 14, does not indicate the latest addition to the plant which consists of the extension of the iron foundry to the left as far as the railroad track.

Special machines of much interest are scattered through the machine shop. The ordinary patterns and sizes of valves are made by the thousand yearly, and as a result special tools are an obvious necessity. The largest drill is a Warren radial drill with a range from ¼-in. to 3-in. holes, with a vertical capacity of 6 ft. and a 5 ft. radial arm. Besides these motions the main arm has a revolving motion which allows the workman to tip the drill to any angle, and exactness is provided for by an index and a graduated scale.

Another notable object is a large Putnam planer, said to be the widest of this make ever built. It will plane 8 ft. wide and high, and the bed has a movement of 15 ft. By a neat device the belt is shifted gradually at the end of each stroke avoiding shocks and undue strain. This planer weighs 30 tons and cost $6,000 in place. It rests on heavy masonry foundations, and is used in finishing the larger gates, which have been made up to 36 ins. in size, and may be made as large as 48 ins.

The tapering wedge shaped plug or gate peculiar to this company's valves requires the use of an angle face plate which carries the plug in the lathe so that one face of the plug is at right angles to the direction of the motion and in position to be cut by an ordinary lathe tool, but the appearance of the plate as it revolves is very striking and might be described as being "very drunk indeed." When one side is finished, the plug turned and mounted now upon its finished face, the other face is operated upon.

The body of the valves is in like manner mounted at an angle upon a special chuck, when the interior seats are to be trimmed, the tool operating through the central hole of the valve. All flange holes are marked and drilled by jigs and templates containing hardened steel bushings and the work is thus made as interchangeable as gun work.

Threads for hydrants and heavy valves are of the truncated or half-**V** form, being neither square nor full **V**-threaded. Reference to hydrant threads leads us to speak of one of the most troublesome features connected with the manufacture of hydrants. There are nearly as many different forms and sizes of hydrant nozzle threads as there are cities and towns which buy hydrants. This company has fitted up a large rack or series of shelves containing steel plugs and nuts, which represent accurately the thread used by each one of their customers, and it is seldom that a new customer finds a thread exactly like his, even in this collection representing all parts of the country and numbering several hundred.

On the second floor of the machine shop, which has a line of shafting on each side of the room we find, in addition to many common lathes fitted with special chucks, five fine turret lathes, made by the American Tool & Machine Co., of Hyde Park, Mass., and costing $1,200 each. One of them is shown in Fig. 15. Each turret or turn-table contains six different tools which are brought to bear one after another upon the mounted work and finish it in many cases before it is taken from the machine, and without moving it, having once put it in place.

A little machine shown in Fig. 16, of much interest and great usefulness, is a Sawyer magnetic separator, which separates the brass and iron filings which are swept up together on the floor. A revolving drum about 10 ins. in diameter is provided with horse-shoe magnets, whose poles point to the circumference, and this is covered with thin sheet brass over the poles of the magnets. Above is a hopper into which the mixed brass and iron chips are shoveled and, by several revolving and diagonally bent arms, a feeding chute at the bottom is jarred sufficiently to cause the chippings to fall upon the magnet wheel in a stream.

The brass particles fall off into a box in front and below, but the iron bits are held by the magnets until they are forcibly removed by a revolving brush into a box behind the wheel. When much iron is present the chippings may be put through the machine two or three times, but ordinarily once is sufficient. This work was formerly done by boys with large horse-shoe magnets.

Complete hydrants cannot be made in any considerable number in advance of actual orders. This is because of the great variety in the diameter and length of the barrels, the number and character of

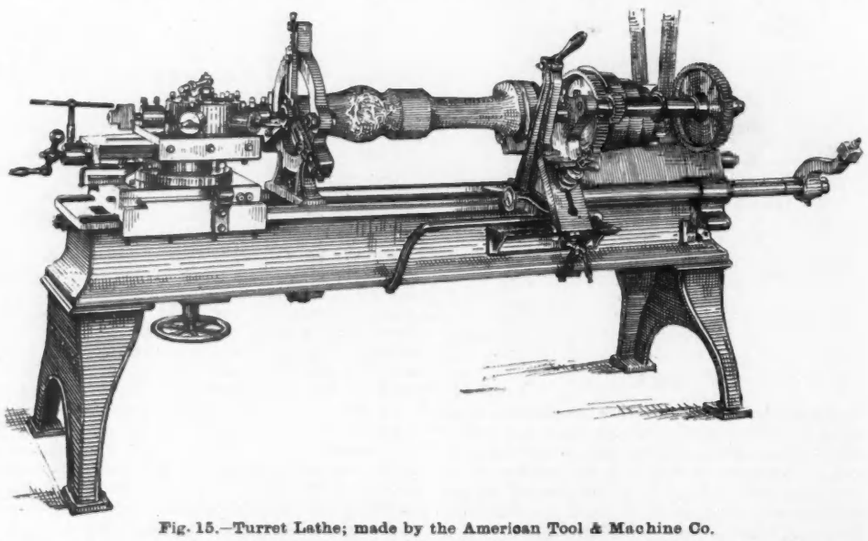


Fig. 15.—Turret Lathe; made by the American Tool & Machine Co.

the nozzles, the size of the bottom connection, the size and form of the nut, and finally the size and

shape of the nozzle thread, that exists in the combinations that customers may require.

Separate parts are kept in as forward a state of preparation as is possible and the assembling of the standard combinations is quickly done. All valves and hydrant gates are tested by either steam or hydraulic pressure before leaving the shop. The ordinary test for water gates is 150 lbs. per sq. in., but special gates for hydraulic work which have to operate under a pressure of 3,000 lbs. per sq. in. have been tested to 4,000 lbs. per sq. in. without showing any signs of leaking.

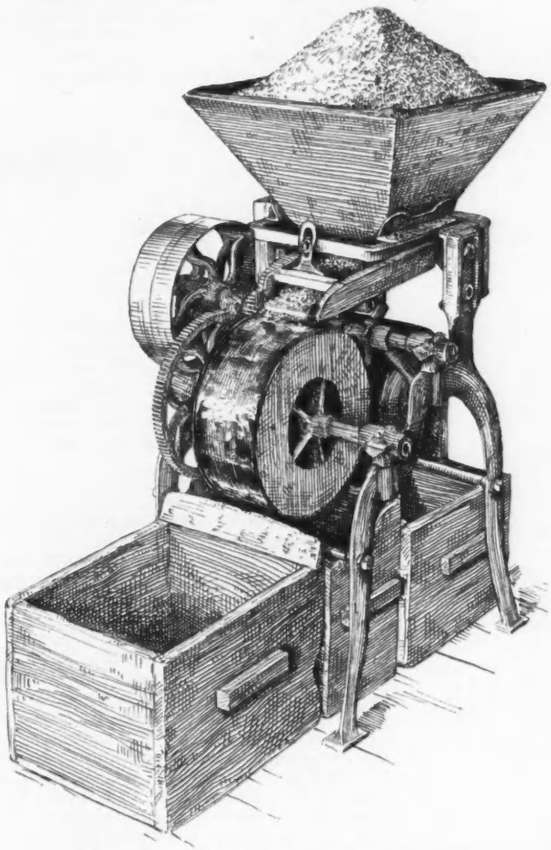


Fig. 16. The Sawyer Magnetic Separator.

THE VYRNWY DAM for the Liverpool water-works is approaching completion. The great straining tower, which stands out in the future lake, and will be approached by a bridge from the new road, is already some 10 ft. or 15 ft. above the water-line, and is being pushed on very rapidly. The heavy work of the masonry dam is almost finished. Out of the 33 arches—two of which form the valve chambers—spanning the whole length of the crest of the dam, 25 are completed. The closing of one of the two circular discharge tunnels through the dam has been begun. These were required to pass the waters of the river Vyrnwy during the progress of the works, and calculation, based upon the rainfall, showed that they must each be made 15 ft. diameter, and that even with this size a great flood might be expected to rise several feet above them. The first step towards closing them, which has already been begun, is to reduce the diameter several feet by rings of blue brickwork in Portland cement. The final stoppage will be effected by building up the reduced tunnel with horizontal work, through which the discharge pipes will pass. It is expected that impounding will be begun this year, and it is estimated that the future Lake Vyrnwy—the largest and most striking lake in Wales—will be completely formed before next spring.

ON the aqueduct there are still some important works unfinished. The imposing water tower is nly about half done. The shafts for the tunnel beneath the Mersey, through which the steel pipes of the aqueduct will pass, are only now being sunk, much delay having been caused by legal difficulties.

A New Method of Electric Traction.

Mr. RUSSELL A. DENISON has simplified the electric motor for street railway service, says the Providence *Journal*, by replacing the motors of high armature speed, geared down to the driving axle, by a single 15 H. P. motor with the armature shaft prolonged to carry a worm wheel which meshes directly with a gear wheel on the driving axle. There is a saving in number of parts and weight. Mr. DENISON estimates the armature speed at 1100 revolutions per minute, which with 25 teeth in the worm gear and 30-in. wheels under the car will give a speed of 4 to 6 miles per hour.

Power may be taken from overhead; but for roads already in operation Mr. DENISON has devised a special conduit with the current carried in a rail, but so arranged as only to be active when the contact trolley is passing.

To accomplish this, he uses a composite rail made in halves with an inch opening at its top forming a deep groove. In this as the two parts of the rail are bolted and keyed together is a one-quarter inch insulating strip of asbestos fibre treated with asphaltic insulating material U shaped in section and of sufficient elasticity to allow of the expansion and contraction or the metal. At the bend of this unsulating U is laid the conductor of ⅜-in. copper wire. Filling all the space above this to the surface of the rail is a flexible packing of woven asbestos rope saturated with the asphaltic compound. This rope can be strengthened as desired by weaving in an iron wire. The rope is rectangular in section, ½-in. wide and fits snugly, allowing only the small space left by the bend of the ⅜-in. wire where water could possibly get in. No drain connection will be necessary with this form of conduit, as all the water which could get in can readily be swept out by a brush attached to the car. The current is taken off the wire by a trolley wheel which runs in contact with the wire, the flexible packing curving over it as it goes and being pressed back into place in the slot in the rail by a follower wheel. The trolley is thus practically running within the rails, although by a lever manipulated by the runner, it can be lifted away from contact with the conductor when it is desired to break the connection. A trolley of this kind is located on each side midway between the wheels and a conductor is imbedded in each rail.

For power Mr. DENISON proposes to use the storage cells of the Gibson Electric Co.; 150 of these 7×9-in. cells, he estimates, will furnish 10 H. P., while space is provided for 250 cells. The important claim is made that this battery will return "90 per cent." of useful effect, and that they are practically indestructible. A Boston company owes the rights to Mr. DENISON's inventions.

Permeability of Mortars of Portland Cement.

Messrs. L. DURANDE-CLAYE and P. BEBRAY in a recent number of the *Annales des Ponts et Chaussées*, describe a series of experiments on cement mortar taken from various marine works in France, Belgium and England. All of these mortars were permeable. In the experiments, a block of the mortar was placed in a dish in such manner as to divide the dish into two compartments, leakage past the block being prevented by cementing the sides of the block to the dish with plaster. A 6 per cent. solution of magnesium sulphate was then poured into one compartment, and as it filtered through the block it was removed by a siphon on the other side, a fresh solution always taking its place.

At the end of 16 days a fissure 3 or 4 centimetres long appeared in the block, and, on the next day another crack was seen and the block swelled in the process. Experiments were then tried with ordinary water and also with solutions of chloride of magnesium and sulphate of magnesium. In these tests a glass tube 1¼-in. in diameter was plugged at one end with the cement mortar and closed at the other with a rubber stopper; through the latter passed a glass tube 40 in. in length connected with a Marriotte flask containing the solution. The cement mortar in each case was made of one part cement to four parts of sand by weight, mixing with .07 to .12 of water by weight, according to the different experiments.

In all these experiments the rate of filtration was at first somewhat rapid, but it diminished in time until it was extemely slow. The glass tubes invariably cracked after some days owing to the swelling of the cement plugs. In the three series of experiments made; in the first set the mortar with 9 per cent. of water was the least permeable; that with 7 per cent. was extremely so, as was that with 11 per cent. In the second series of tests, the 11 per cent. of water was best, and in the third, the 10 per cent.

The action of the 6 per cent. solution of chloride of magnesium was much less injurious than the solution of magnesium sulphate of the same strength. Chemical analysis showed that the cement after being acted upon by the latter contained from .75 to .80 of sulphuric acid; proving that in the double decomposition taking place between the calcium and magnesium salts, a portion of the calcium sulphate remained in the body of the mortar. The authors were disposed to attribute to this fact the dislocation of Portland cement masonry exposed to the action of sea-water; for while the magnesia produced is in the state of a thin cream without consistence, the sulphate of lime forms crystals and exerts considerable internal stress.

The United States and American Inter-Oceanic Canals.

Lt. Commander C. H. STOCKTON, in a late article on "Some Aspects of the American Inter Oceanic Canal Question", published in *America*, treats rather of the diplomatic history of the various canal projects, and their effect upon the United States, than of their engineering or commercial sides. He concludes that we as a nation can not afford either to have a canal at the Isthmus partially neutralized when opened, or under the control of any one power. Such a canal should be completely neutral in war as in peace; and such neutrality should be guaranteed by all the powers, and should be enforced by the State through which the canal passes, aided by the great power most directly interested. This interested power is the United States, on account of its proximity to the canal, predominance on the continent and the importance to it of the transit facilities.

With regard to our ability to perform this duty, Lt. Commander STOCKTON tells some unpleasant truths and gives some sound advice. He says the first thing requisite is an adequate naval marine; the natural strength and resources now exist—the will alone is wanting to make these effective. Looking toward the ocean, many people are led to underrate the power of our country. We find there a mercantile marine declining in the face of an increasing commerce and a navy of weak and obsolete vessels; and abroad we have a diplomatic and consular service lacking permanency of tenure and liberal support. The result is that we can hardly blame foreign powers for a want of proper appreciation and respect for the country that permits itself to be so represented among them.

But looking landward; we find "a country one of whose railway systems alone carries more tonnage than all of Great Britain's merchant marine; whose internal commerce equals the entire foreign commerce of the five leading maritime nations of Europe; a country which is already the greatest manufacturing nation in the world; and finally, a country with abundant capacity to support a population which should number 600,000,000 by the close of the next century."

The author then says that to the want of an adequate naval force and policy is mainly, if not solely, due any existing indifference or disrespect on the part of foreign powers. And he then looks forward to the opening of a canal across the Isthmus as an agent in enforcing us to restore our mercantile marine to its old place upon the ocean; and to create such a navy as will maintain this water highway free for American trade in peace or war, and sustain our national dignity and protect our citizens abroad and our territory at home.

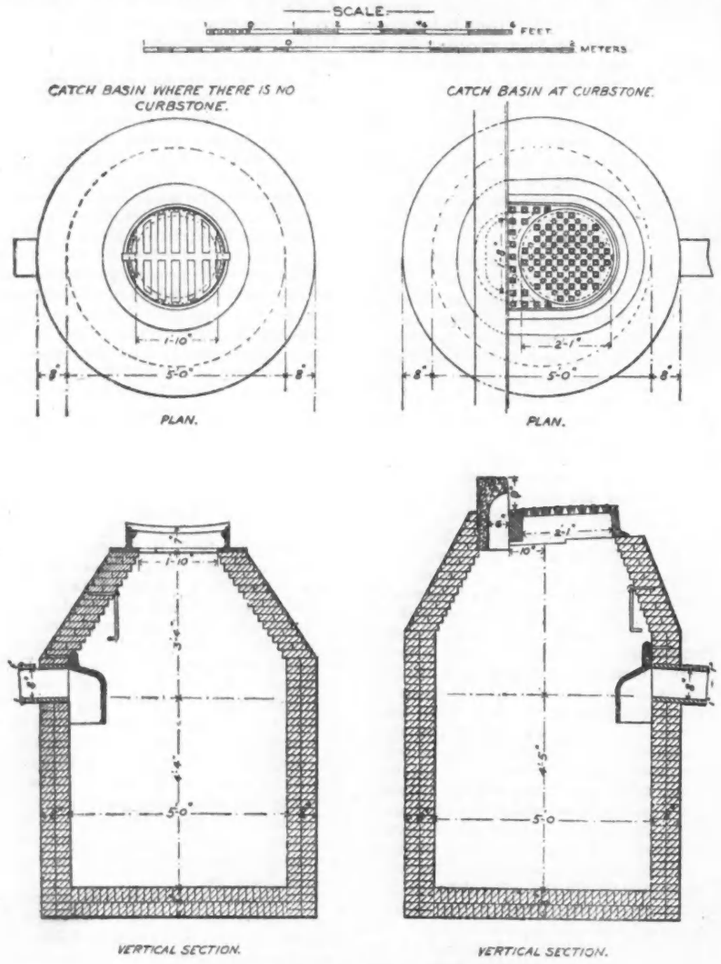
Boston Parkways. Road and Drainage Construction.

Since the publication of the plans and description of the Boston Park system, given in ENGINEERING NEWS of date Aug. 27, 1887, considerable work has been done on the parkways and roads, sections of which are shown. The construction of the roadway for the Back Bay fens, according to the report of the city engineer, has been as follows: The roadways were first excavated and graded to a depth of 8 ins. below finished grade, rolled, and curbstone set. The gutters, 4 ft. wide, were paved with rectangular granite blocks laid at right angles to the line of curb, with surface 7 ins. below top of curb, rising 2 ins. toward the street, in the width of 4 ft. The roadway was then filled up with broken stone, laid in layers of varying sizes, viz.: first 4 ins., about 4 ins. in diameter; then 3 ins. depth of stone 2½ ins. diam.; then 1 in. depth of stone 1 in. in diam.; and finally, a layer of screened gravel or fine stone screenings from the crushers, for the top surface.

On laying, each layer was watered and rolled with 2½-ton sectional grooved rollers. This is considered as an economical form of roadway adapted to localities where settling may after a time require regrading, and where there is good underdrainage. Other particulars will be found in cut. The Department has purchased all stone by weight instead of by the usual method of measurement in carts, with an increase of accuracy.

Fig. 3 shows a section of the driveway built to the top of Bussey Hill, Fig. 2 showing the catch basins, which are located on both sides of the roadway 300 ft. apart, with outlets on side hill below the roadway. Tile drains, laid 2 ft. 6 ins. below the surface and under the gutters, drain the subsoil, and discharge into the catch basins. The roadway was subgraded to allow a depth of one foot for stone, which was laid 9 ins. deep for the first bed, and evened, then covered with 3 ins. of crushed stone 2½ to 1½ ins. in diam., and rolled and finished with a layer of screened gravel or stone dust, watered and rolled. The gutters were made of cobblestones from the excavation and are 3 ft. wide.

The walks are separated from the gutters by a border of loam 2 ft. wide and 1½ ft. deep, and are built of 6 ins. of crushed stone, covered with stone dust, watered and rolled. They have a fall of ½ in. to a foot from edge to loam border.



Details of Catch-Basins; Boston Parks.

Projected Railway in Asia Minor.

Some months ago there was considerable talk about a projected railway in Asia Minor, which was to connect Constantinople with Bagdad and the Persian Gulf. Mr. H. M. JEWETT, U. S. Consul at Sivas, Turkey, has given a very complete account of the country and the cities through which the line would pass, and from his report we condense the following article:

The proposed line (the route of which may be traced on the map in our issue of Aug. 27, 1887,) starts from Ismid, the present terminus of a short line of railway connecting that town with Scutari, the Asiatic suburb of Constantinople. Its length is about 1,400 miles and the estimated cost $77,500,000 Throughout its length it traverses a country well populated, abounding in mineral resources and producing great quantities of grain. The great advantages to the country, commercially and as a civilizing influence, of such a road are obvious. It would create a new Asia Minor, open to the trade of the world a vast territory now closed, totally change the character of the country and the people, and practically advance Turkey in Asia from, say, the 16th to the 19th century. This project will, if carried out, shorten the distance between Europe and India by 9 or 10 days, and give a route to the East independent of the Suez Canal.

The following are the principal points along the proposed route taken in order: Between Ismid and Angora, a distance of some 150 miles, there are no towns of special importance, though the country is well settled. The country is mountainous and in character resembles Swiss scenery, and in the vicinity of Boli there are extensive forests of pine and wild cherry. The villages are surrounded with fruit orchards. Some 50 miles before reaching Angora the woods disappear and are replaced by sandy, treeless tracts crossed by deep rough ravines. Angora has a population of 20,000 and is the center of the mohair trade; it is an important city, water power is available, and the province of which it is the capital is rich in minerals. The imports amount to about $1,125,000 per annum, principally from England and France. The route crosses the Denek mountains 50 miles beyond Angora, and on this range there are silver mines.

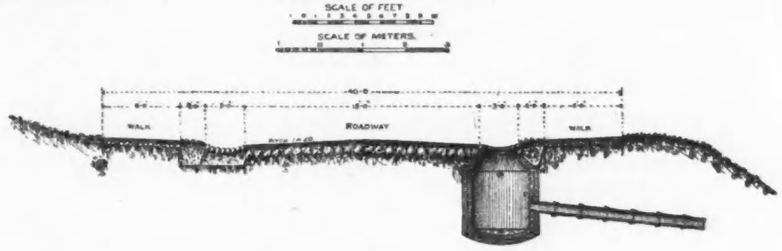
Youzgat is a walled city of 10,000 or 15,000 inhabitants, and after passing the hills among which it is situated the line traverses a succession of fertile plains, thickly covered with villages. From Youzgat a branch would probably be built to the wealthy city of Kaisarieh, which has a population of 60,000, whose trade is principally in hides, yellow berries, wool and gum tragacanth. A line extending south from here, through the Ante Taurus mountains, *via* the Cilician Gates, 150 miles, would connect the proposed main line with the railroad between Mersine and Adanah, and give an outlet on the coast. Sivas, with a population of 48,000, is an important city, occupying a strategical position commanding the approaches from the Russian and Persian frontiers; it is the center of a large grain district, and near it is an extensive mineral district; it is suggested as a good starting point for a branch to the Black Sea.

At Kharpoot the line would cross the Euphrates. The city stands on an eminence at the termination of a range of hills, and below it as a fertile plain 40 miles long and 4 to 6 miles wide. It has a population of 12,000, or 100,000, including the numerous surrounding villages. Diarbekir had formerly a large silk trade, but it has declined. Here commences the navigation of the Tigris, and goods are floated down to Bagdad on rafts made of inflated skins. Following the valley of the Tigris the line reaches Mosool, a city of considerable size. From this city to Bagdad the Tigris is a broad stream, being enlarged by tributaries from the mountains of Koordistan. The banks of the stream are covered with a thick jungle. In the neigborhood of Kerkook, on the eastern side of the Tigris are inexhaustible petroleum and naphtha springs, said to have been flowing since the days of Alexander the Great, and it is suggested that, with proper methods of refining, the oil from this region might become of great commercial importance. This petroleum was largely used in Bagdad and Basserah some years ago, but as the natives did not understand how to refine it properly it has been superseded by Russian and American oil. Bagdad, the terminus of the proposed line, has a population of about 80,000 and is the commercial center of Turkish Arabia. One of the chief exports is wool, but the trade has declined of late years owing to the competition with Australian wool. The quantity of grain raised about Bagdad and along the Persian Gulf is immense, and at times so abundant is the supply and so inadequate the means for transportation that wheat is used for fuel on the gulf coast. Gall nuts and gum tragacanth are gathered on the surrounding hills. The soil is capable of producing unlimited quantities of cotton, but little is actually grown. Mulberry trees grow in abundance, and experiments in silk manufacture are reported to have resulted favorably. Rice of very good quality is produced, and the cultivation of sugar cane has been introduced from Egypt. From Bagdad navigation to the

Persian Gulf and India is easy, and should the railroad be built, this city is sure to attain a considerable commercial importance.

"As to the probable needs of this great extent of country when opened up by the railroad, it may be said that they include everything. Practically nothing is produced in the manufacturing line now. With the advent of the railroad, with the new towns and cities that will spring up, the new resources and industries developed and especially with the new ideas and wants which civilization creates, there will be a new market and a constantly increasing demand for almost everything which Europe and America manufacture."

The population of Asia Minor is made up of a large number of diverse races, religions and languages,



Bussey Hill Drive; Catch-basins.

and it is hardly possible for any one who has not traveled there to realize the low position which the people occupy in the scale of civilization. Except in the larger towns education is almost unknown. Manufactures, except of the simplest kind do not exist, and in agriculture, in the construction of houses, in handicrafts, etc., there is little improvement on the primitive methods of the earliest ages. The male adult population of the district known as Turkish Arabia, and having Bagdad and Bassorah as its commercial capital, is estimated at 1,976,000.

Irrigation in India, Italy and Spain.

India.—With its vast population of 200,000,000 this country requires more than a fair harvest to prevent famine in many localities, and it is this motive which has led the Government to build enormous canals and irrigating appliances. The works in course of construction and projected are estimated to cost $175,000,000, and the rate of expenditure is now many millions annually. The work can be done cheaper in that country than in almost any other as the wages of a skilled laborer are only 50 cents per day, and of an ordinary laborer 12 cents per day. Earth excavations can be made for 5 cents per cu. yd., and masonry from $1.50 to $3 per cu. yd. In India four systems are in operation: canals, tanks or reservoirs, the inundating system, and wells. The Ganges canel is 10 ft. deep, 170 ft. wide at its upper part, 900 miles long, and is intended to irrigate 1,500,000 acres. It can carry 7,000 cu. ft. of water per second. It cost about $12,000,000 and would probably have cost many times as much in this country. This canal is navigable, and was built, and is owned by the Government. There are several others which rival it in magnitude and importance.

The tank system prevails in Madras, where, it is said, there are 53,000 tanks, with 30,000 miles of embankment, and 600,000 separate masonry sluices and weirs. They are generally shallow,—from 6 to 10 ft. deep. The earth for the walls was carried in baskets and deposited in layers from 6 to 8 ins. thick and then packed by the feet of the natives. Four posts were placed in the crest of the waste weir so that a light dam could be constructed to hold the water as high as possible, but would be swept out in case of a flood before the water reached the top of the embankments. The Government owns these tanks, and the revenue from them is $7,750,000. Some of them are supplied by natural drainage and others by artificial channels. Their number is decreasing, however, some being filled with silt and others being replaced by the canal system.

Inundation canals were formerly much used, but are now being superseded by permanent or perennial canals, As they depend upon freshets for their supply of water, they are very uncertain, and are also especially liable to get out of order.

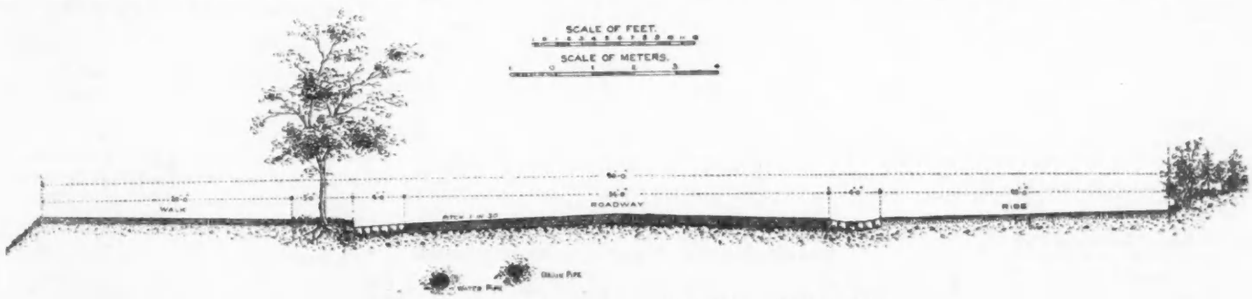
Wells furnish a very large area with water. They are square pits lined with masonry, and are from a few feet to 60 ft. in depth, each well watering from 3 to 10 acres. The means of getting the water out of these wells and distributing it, is extremely crude.

Italy.—The first canal of which there is an authentic record, was built in the twelfth century. The large Muzza canal was built in 1520. The rainfall in Italy is about 37 ins. or 38 ins. annually in Lombardy and about 22 ins. in Piedmont, but notwithstanding this fact a very large area is irrigated in these provinces.

Italy uses about 24,000 cu. ft. of water per second and 1,600,000 acres of land are irigated. In the 700 years in which irrigation has been practiced in Lombardy, it is estimated that $200,000,000 have been expended, with the result that the whole country is a garden. The State owns most of the canals, but irrigation associations are formed to administer affairs in various localities.

Spain.—With its high temperature and scanty rainfall, Spain needs irrigation more, and repays it better than almost any other country. Irrigated land is often worth from $700 to $800 per acre, while the same land without such improvement is only worth $80. The Spaniards received their ideas of irrigation from the Moors, and many of the older systems are the work of that people. The area of land irrigated in Spain is, according to official reports, 4,439 sq. miles. The principal canals, however, only irrigate 500,000 acres, the multitude of smaller canals and reservoirs furnishing water for the remainder. Wheels, with buckets attached, are very generally used for lifting the water. The motive power is either animals or the current of the stream. Most of the canals are owned and operated by capitalists but under very strict Government regulations.

In France irrigation is more of a local than a national enterprise. The rainfall is from 16 to 32 ins. annually, so it is not a necessity. In England there are now extensive water meadows, and irrigation on the Italian plan has recently been attempted.—*Report of the Commissioners of Irrigation of California.*



General Cross-section, Bussey Hill Drive; Boston Park.

ENGINEERING NEWS.

NOTWITHSTANDING the displeasure of Kansas City residents over the action of the railways in taking off the limited express trains between Chicago and that city, there seems to be no present prospect of their renewal. The rumor that the Santa Fé was not a party to the agreement and that it proposed to put on a "flyer" that would draw through business away from its rivals, proves to have no foundation in fact. The agreement expires April 1, 1889 and until that time it seems likely that travelers between Kansas City and Chicago will have a good opportunity to exercise the virtues of patience.

THE MANCHESTER SHIP CANAL CO. held a meeting of its shareholders lately and the following is the substance of the last half-yearly report:—The total amount of share capital alloted on June 30, 1888 was £7,386,440, £4,000,000 being preference and the remainder ordinary. The total amount received to same date was £3,513,769, and the amount expended was £3,401,244. The directors' estimate of further expenditure on capital account for the current half-year is £1,304,675. The actual amount of land purchased is 2,891 acres, and they had still 1,163 acres to secure. The work progresses well; over 8,500 men and boys are employed on the work proper and 3,000 more on the Bridgewater undertaking. There are 98 locomotives, over 3,000 cars, 51 steam navvies, 49 steam cranes and 104 pumping and other steam engines on the work.

THE THAMES RIVER BRIDGE, at New London, Ct., now under construction, has some interesting engineering features connected with it, according to the *Providence Journal*. The foundations for the piers require dredging in 50 ft. of water, and this is being successfully done with the ordinary scoop-dredge. Spliced piles 130 ft. long are also being handled and driven by a 4,800 lb. hammer; these piles are sawed off 50 ft. below the water surface. The pier-work is well advanced and the crib for the pivot pier is built and is about ready to be sunk on its piles. Col. MONROE is the engineer in charge.

PRESIDENT SPENCER has appointed M. N. FORNEY, A. J. CROMWELL, W. H. HARRISON, J. N KALBAUGH, a commission of mechanical experts to examine thoroughly all shops, tools, etc., of the entire Baltmore & Ohio system, and to report upon needed reforms and improvements in the machinery department, looking to more economical and effective work; the modernizing, if necessary, of the machinery both locomotive and stationary, the concentration of work, and the better division of labor between different parts of the system. The commission will visit not only the shops of the B. & O., but also those of several of the leading railways of the United States, with the view of instituting comparisons and of adopting for the B. & O. the most modern and approved methods and appliances to be found in use anywhere.

ENGINEERING NEWS

AND AMERICAN RAILWAY JOURNAL

Published Weekly at Tribune Building, New York.

VOL. XX. Saturday, September 15 1888.

D. McN. STAUFFER, A. M. WELLINGTON.
EDITORS.
GEO. H. FROST. - - - - - BUSINESS MANAGER.

Subscription. — UNITED STATES AND CANADA, $5.00 *per Year; $2.50 for Six Months; $1.50 for Three Months; Single Copies,* 12 *cents.* FOREIGN COUNTRIES, $6.56 *per Year, or* 3 *cents per number additional.*

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Drawings for publication *should preferably be in plain black and white, considerably larger than they are expected to appear, with letters and figures in pencil only, all lines clean and bold.*

Coming Technical Meetings.

Street Railway Association of the State of New York.—Annual convention in New York., Sept. 18. Secy., W. J. Richardson, Brooklyn, N. Y.

Engineers' Society of Western Pennsylvania, Pittsburg, Pa.—Regular meeting, Sept. 18. Secy., S. M. Wickersham, Penn Building.

Boston Society of Civil Engineers, Boston, Mass.—Regular meeting, Sept. 19. "House Drainage". Secy., S. E Tinkham, City Hall.

Association of North American Railroad Superintendents.—Next meeting at the Southern hotel, St. Louis, Mo., beginning Sept. 19. Secy., Waterman Stone, Providence, R. I.

American Society of Civil Engineers, New York.—Regular meeting, Sept. 19. Secy., John Bogart, 127 E. 23d St.

Engineers' Club of Kansas City, Mo.—Regular meeting, Oct. 1. "The Complete Sewerage of Kansas City." Secy., Kenneth Allen, 19 Deardorff Building.

Civil Engineers' Society of St. Paul, Minn.—Regular meeting Oct. 1. Secy., Geo. L. Wilson, City Hall.

American Institute of Mining Engineers.—Next meeting at Buffalo, N. Y.; beginning Oct. 2. Secy., R. W. Raymond, 13 Burling Slip, New York.

Civil Engineers' Club of Cleveland, O.—Regular meeting Oct 9. Report on Civil Engineering. Secy., James Ritchie, Case Library Rooms.

Engineers' Club, Philadelphia, Pa.—Regular meeting Oct. 6. Secy., Howard Murphy, 1122 Girard St.

American Society of Mechanical Engineers.—Convention and annual meeting at Scranton, Pa.; beginning Oct. 15. Secy., F. R. Hutton, 280 Broadway, New York.

American Street Railway Association.—Next meeting at Washington, D. C.; Oct. 17. Secy., W. J. Richardson, Brooklyn, N. Y.

THE newly established fast run of the West Coast train from Euston (London) to Edinburgh, 400 miles in 8 hours, including one stop of 23 minutes and two others of 3 minutes each, with some slowing up at four other points, is certainly a remarkable performance, although far from up to the great run on the West Shore about two years ago, which perhaps will long remain the greatest in the world. That run, to be sure, was only a special one, while this is a regularly scheduled train, but the West Shore run was made without any special preparations or notice, with the regular engines and crews, and could undoubtedly have been repeated every day had it seemed worth while.

The West Shore train consisted of,

	tons
Engine and tender	78.65
3 cars	76.83
Total	155.48

The time was,

	miles	no. stops	miles per hour av.	miles per hour ex stops
Buffalo to Weehawken, 423 miles		12	45.04	60.2
Buffalo to Frankfort, 202 "		4	50.4	64.03
Buffalo to Genessee 61 "		0	65.25	71.6

[4 minutes lost time per stop in addition to lost time standing still is allowed for stopping and starting.]

The Euston-Edinburgh train according to *The Engineer*, consisted of 4 eight-wheeled cars (American type) weighing about 80 gross tons, or about 90 net tons, and was thus appreciably heavier than the West Shore train. The weight of engine and tender was strangely omitted, but from the description we take it to have been practically identical with (if anything a little lighter than) the West Shore engine's. The time made was as follows, making *no* allowance for lost time stopping and starting:

	miles	no. stops	miles per hour ex stops
Euston to Crewe	158	0	53.57
Crewe to Preston	51	0	53.6
Preston to Carlisle	90	0	55.0
Carlisle to Edinburgh	101	0	55.5

One 8-mile stretch of down grade was run in "7 minutes" or 68.58 miles per hour. The timing seems to have been very crude for a trial run. The whole run of 400 miles was made in 7 h. 53 m., out of which should be deducted 35 minutes for three stops, or 54.8 miles per hour, excluding stops. Excluding lost time stopping and starting, about 18 minutes more should be deducted, making the running time in motion 57.14 miles per hour.

The Engineer very justly questions whether it is worth while to keep up such high speed to save half an hour of time, out of a run only 8½ hours long. Our Chicago limited trains average almost exactly 40 miles per hour including stops, which are quite numerous, making the running speed in motion practically the same as the above; as is shown by the West Shore run, which was much less interfered with by stops than the ordinary "limited" run, yet in which a speed of over 60 miles per hour in motion was required to show an average for the whole run of 45 miles per hour.

The above excessive rate of speed to Edinburgh, although it was "schedule" for a time, has been abandoned since September 1, and was only attempted as a form of railway war. The schedule time is now 8½ hours, or 47 miles per hour, which is quite fast enough.

SOME wag has been guying our friend, *The Engineer*. It has heard the surprising piece of news that an "American syndicate of steamship owners" is not only going to establish a "new service of American liners" to England, but is also plotting to establish a "new port to become a rival to Liverpool" by building some new docks on the Dee at Mostyn: and it deems this precious bit of news sufficiently important to devote to it a leading editorial, pointing out in a ponderously facetious way the objections to "the British investor being again appealed to by Brother Jonathan", etc., etc. *The Engineer* need borrow no trouble. In the first place there are no "American steamship owners" worth speaking of, certainly not enough to form a syndicate, and in the next place, after there are American steamship owners, and they have formed a syndicate, and built their steamers, they will hardly be likely to be so foolish as to think of hunting up investment enterprises in England, which the English themselves have not deemed worth taking hold of.

THE question of water storage on the western tributaries of the Mississippi river is now before Congress, and its first reception there is promising. As shown in our last issue in the letter of Maj. POWELL, it is a question in every respect worthy of the serious attention of our law makers, and it holds out the double prospect of irrigating land now arid and making it rich and wealth producing, and, if its theory holds good in practice, at the same time helping in the maintenance of a navigable channel in the lower Mississippi by the mere act of arresting a certain amount of the sedimentary matter that now undoubtedly works mischief when it reaches the main rivers. Some members of the Senate seemed to view this bill as an attempt purely local in its purposes. But while we believe the United States Government would even be justified in this when it was a question of increasing the area of revenue-bearing lands and extending population, the question is not local if the whole Mississippi valley is to participate therein.

The real purpose of the bill is simply to ask the Government to appropriate money for the survey of the sites for water storage and to test the cost and feasibility of the scheme. This much the Government can well afford to do; because, the proper solution of this part of the problem is rather too expensive for private enterprise; and secondly, because in the event of the success of the scheme the Government will reap enormous returns in the increase in State wealth and population that must follow. The actual construction of these reservoirs and the division of their cost is a subject for future consideration—after we know that they can be built for any reasonable sum, and can be usefully located. The Colorado papers suggest that the better plan would be for Congress to donate a certain amount of arid land to the States on condition that they will construct the reservoirs and reclaim the land. In such an event the Government would only give that which now has little if any value, and the State would control the works for the benefit of all its citizens and recoup itself by the sale of improved land for all expenditures. As the water belongs to the State now and its distribution should in any event be regulated by State laws, this suggestion seems sensible, and any other disposal of the question by the central Government would necessitate new laws to avoid an otherwise rather complicated tangle of control.

THE heavy 100-lb. rail introduced by Mr. SANDBERG is making remarkable progress in Belgium. First 300 tons were laid, then 1,000 tons, and now 10,000 tons are ordered to be put down this year. As Belgium has only some 2,750 miles of railway, requiring only 432,000 tons to relay the whole of it (single-track) this heavy order for a single year shows better than words could do that the result of the use of such rails so far has been eminently satisfactory. Mr. SANDBERG says that he is told that "experience has already shown not only greater safety and comfort with the heavy rails, but an actual economy of maintenance, sufficient to repay the extra outlay for the heavier rail." It is anticipated that the cost of maintenance of rolling stock will also be materially reduced. He says further that leading railway administrations in other continental countries contemplate increasing the weight of their rails by 20 to 30 per cent.

In this country we are making steady progress, if rather slow progress, in the same direction. A 60 or 66-lb. rail is no longer considered "heavy", on any lines of considerable traffic; 75 or 80-lb. rails alone are so regarded. The aggregate mileage of such rails is still small, but it is increasing, and the mileage of rails lighter than 60 lbs. is rapidly decreasing. It will not be many years, we are confident, before 90 and 100-lb. rails will be common enough on our trunk lines. If true economy prevailed they would be common enough now.

IT gives one a clearer idea of how very slowly such changes progress, however, to find by the

last edition of Poor's Manual that there are still 60,388 miles of iron rail track in the United State against 128,959 miles of steel rail track. These figures, it is true, are including sidings, but considering that it is at least 8 years since iron rails ceased to be manufactured at all, one would have expected that the total of iron rails would have figured at far less by this time, and in fact, that there would be hardly any left on main line. Nor can we believe that Poor's statistics are quite correct, for there has been unquestionably an immense amount of iron rail taken out of both main track and sidings and scrapped, in the past few years, yet according to POOR the total of iron rail has only diminished at the following slow rate.

Date.	Miles iron rail in track.	Decrease.
1883	70,692	
1884	66,254	4,438
1885	62,495	3,759
1886	62,3 4	171
1887	60,388	936

Certainly more than 1,100 miles of iron rails must have been scrapped in the United States in the past two years, even remembering that the constant extension of sidings saves from the scrap heap most rails which have any service whatever left in them.

IT is to be regretted that POOR'S statistics of trackage are not given in a little different form, like that subjoined, instead of having double track, third and fourth track and sidings lumped all in together. The form is probably an inheritance from the days when there was not enough double track in the United States to be worth separate report —which is not so very long ago—as all the necessary statistics to give double track and sidings separately appear to be collected. But it is time now for a change, especially as the increase in double-trackage is one of the most significant evidences of the tendency of the times. We have at considerable trouble been through the volume and extracted the total amount of double trackage, as carefully as may be (but without attempt at strict exactitude) and from the data thus obtained compiled the following table, showing approximately the actual condition of our track in the various sections of the United States. We have added to the bare figures another table giving certain percentages to aid in comprehending the record:

Group of States	Mileage of Main Track.				Sidings	Total Track.
	Single.	Double.	Triple.	Q'adr'ple		
New England..	6,684	1,157	29	.....	1,965	9,835
Middle	18,662	4,764	539	422	7,590	31,977
No. Central....	44,316	1,455	.....	.....	9,611	55,382
So. Atlantic.....	13,451	6	.....	.....	1,652	15,109
Gulf & Miss. V	10,659	2	.....	.....	1,401	12,062
So. Western.....	28,905	0	.....	.....	7,582	36,487
No. Western....	16,848	67	.....	.....	2,291	19,206
Pacific..... ...	8,473	4	.....	.....	811	9,288
Total U. S.....	147,998	7,455	568	422	32,903	189,346

THIS table, werepeat [illegible]; it probably gives the double trackage somewhat too small and the sidings too large by an equal amount, since it was compiled by only once running over the records of the single roads; but it cannot be very materially in error, and as the only record of the kind which exists it is well worth studying. We complete the record by adding the iron rail mileage and percentages of double track, siding and iron rail, taking the total *miles of road* as 100.

The iron rail remaining in track will be seen to be very considerable; surprisingly so in New England. We are quite sure that there is somewhat less than here appears in New England and all other sections, but how much less can only be guessed. The sidings have been assumed to be all iron and the excess of iron only to be in main track, which of course is not strictly true. There are a thousand miles, perhaps, by this time, of steel sidings; but the essential accuracy of the table is not much affected by this unavoidable source of error.

Group of States	Iron Track.		Per cent. of			
	Total miles.	Miles in main track.	Double track	3d & 4th tr'ck	Sidings.	Iron rail in main track.
New England..	3,484	1,519	17.3	0.4	29.4	22.7
Middle	8,830	1,240	25.5	5.2	40.6	6.6
No. Central....	15,739	6,128	3.3	.....	21.7	13.8
So. Atlantic.....	5,450	3,798	.....	.....	12.3	28.3
Gulf & Miss. V.	3,962	2,561	.....	.....	13.1	24.0
So. Western.....	13,393	5,811	.....	.....	26.2	20.2
No. Western....	5,802	3,511	.....	.....	13.6	20.8
Pacific.....	3,728	2,917	.....	.....	9.6	34.5
Total U. S.....	60,388	27,485	5.2	0.7	22.3	18.6

Car and Station Platforms.

A recent suit against the Manhattan Elevated Railway, of this city, raised a point of more than local interest, which is likely to come up at any time on other elevated and suburban railways, and in which the uncertainties of the law were again strikingly illustrated.

The elevated railway car platforms, as every New Yorker knows, have no steps, but come out flush with the edge of the station platforms to the side of the car. Owing to the fact that the New York elevated lines were originally built by two independent companies, the New York and the Metropolitan, which were only consolidated in the Manhattan after they were constructed and equipped, there were at first two differing standard widths of cars, differing two or three inches from each other. For the joint purpose of equalizing this difference and protecting the edge of the platform, an iron platform plate is used, some of which (on the narrower cars) project an inch or so beyond the side of the car, while the others are as much inside of it. The net effect, however, is that the car platforms are now all of one standard width and the station platforms all one standard height and distance from the rails.

These dimensions are so arranged, however, that there is an average distance of about 4 ins. between the edge of the car platform and the edge of the station platform, leaving a gap which must be stepped over by every passenger. In practical work the gap varies from 3 to 5 ins., even on tangents, and is of course still more variable at the few stations on a curve.

At one of the tangent stations (42d St.) some time ago, a Miss Brady was leaving the cars with a friend in something of a crush when she stumbled and fell, either by stubbing her toe against the higher station platform or by letting her foot down into the gap, injuring her knee, to an extent which the jury thought was measured by $5,000. On what specific grounds the jury made this award can of course only be conjectured, but the claim of counsel was (1) that the company was bound to use the most perfect appliances for the protection of passengers, which is undoubted, and (2) that the gap between the car and station platforms was unnecessarily wide and dangerous. It was probably on this ground that the verdict against the company was given, since it was denied in evidence that the platform plate was broken or in bad order at the time of the accident, and there was no evidence to prove that it was, beyond a mere suggestion that it might have been so broken.

Was this a just verdict; and should the platforms in fact be brought nearly together so that it would be physically impossible for the foot to enter between the two? *Prima facie* it was a just verdict, for the mere fact that an accident occurred shows that there was an element of danger in the gap, and that it is physically possible to so arrange the details that there would be no appreciable gap whatever between the two platforms is quite certain. They could, if need be, be brought so close that the joint would hardly be visible to the eye.

But between physical possibility and practical possibility there is a wide gap, and that it would not conduce to safety, but rather to danger, to attempt much closer approximation of the platforms than 4 ins. becomes clear on very little consideration. There is, in the first place, a little play necessary between rails and wheels, and this play cannot be counted on to remain absolutely uniform without employing mechanical engineers for trackmen. Neither can the alignment of the rails be assumed to remain absolutely perfect. For these causes alone at least an inch should be allowed.

In the second place, the luxury of springs cannot well be dispensed with, and almost as essential as the springs are the swing-hangers. Without the latter the riding qualities of of the cars would be greatly injured, and it is indispensable to allow at least half an inch for possible variation due to their motion, and another inch for the tipping of the car bodies, due to unequal loading and compression of the springs.

Finally, there are the possible cumulative errors in the construction of cars and platform which would certainly make it prudent to allow an inch or so more as insurance against the unpleasant possibility of collision with the platforms. When all these causes are considered together, we have good direct reasons why three or four inches of clearance should be allowed for, or certainly why not less than two inches should be essential to safety.

But there are other and more cogent indirect reasons. In the first place, there is always the possibility of the breakage of some part of a car. A broken axle, bearing, truck or spring or side bearing, or swing-hanger, is liable at any time to disable a car so that it is not fit for service, and to throw one end of it 2 or 3 ins. out of line. Would it be desirable or sensible that the platform should approximate so closely that any displacement of the kind would make it impossible to haul the car back over the line until it had been repaired? Of course great displacements cannot be considered, but the great bulk of those which will leave the car in condition to run over the rails at all are small displacements.

Secondly, it is by no means uncommon for passengers to let their feet, or small articles in their hands, project a little beyond the platform plate while they are approaching a station. If the approximation of the platforms were less than 3 or 4 ins. would there not be a possibility of injury in such cases exceeding that from the wider gap when the cars were standing still?

Finally, the most important consideration of all, would it be really safer for the passenger in alighting to have the gap between platforms only 1 or 2 ins. instead of 3 or 4, if there were no other reasons for the wider gap whatever? If it were possible to have the platforms always of precisely the same level, there would be no hesitation in the answer to this question. The closer the two platforms approximate to each other the safer they are. But it is not possible to have the levels always alike. Apart altogether from imperfections of construction, for which some reasonable allowance is required, both rails and wheels wear, springs are of unequal strength and must be easy, and may take some permanent set, loads are very variable, and the floor is liable to be considerably tilted when most of

the load is on one side of the car. At least 3 ins. of variation in the platform level at the side must be expected from these causes, and practically cannot be prevented.

This being so—some vertical gap between the platforms being indispensable—is it really conducive to safety to minimize the horizontal gap? It appears to us evident that it is not. Its effect would be simply to encourage 200,000,000 passengers a year to walk on to and off the platform, as if the two made one continuous solid floor. As a rule they would do so, and the habit would become ingrained; but once in 10 or 20 or 50 times they would not do so, and out of the several million stumbles a year which would naturally result therefrom, a certain considerable proportion would occur when the train was just starting or a heavy weight was just behind, or under other conditions liable to cause serious injury.

As it is now, the gap between car and platform, although not wide, is a visible and distinct one. Every passenger who is entering a car, although he may not see the gap just before him on account of the crowd, sees it on each side or as the train is coming to a stop, and has it clearly on his mind that there is a gap which he must take care to step over. Almost every passenger does in fact take such care. Is it desirable to do anything to lessen such care?

Clearly, we think, it is not, even although it be admitted that in some rare cases, like that of Miss BRADY, injury may result to individuals which in that particular case would have been avoided, or been lessened, had the gap been narrower. The question with that, as with all railway appliances, is not, "Can danger ever arise from it?" for if it were, none of them would ever be adopted, or if adopted, retained in use. They all have elements of danger. The question is rather "Will it on the whole be as safe as, or safer than any other arrangement?"

The truth is, the choice of all railway appliances is the result of a compromise or a choice of evils. The most valuable safety appliances, like train brakes and close couplers, are at times the direct cause of accidents. The first often encourages too fast running, and fails at the critical moment when it was not properly adjusted at the start; the second often causes loss of life by holding cars immovably together when it were far better they should separate. So we might go on to specify occasional dangers from a dozen other approved appliances. Therefore, all that can be done in the beginning is to adopt that plan which seems most likely to be safe, and all that can be done later is to judge, not from single casualties, but from an average of all casualties, whether a change should be made or not, The final test must be that of experience. Had there been a multitude of such casualties as that of Miss BRADY'S in the history of the road, it would then have been apparent the gap was too wide for safety; *i.e.*, that it was a greater danger to the careless than an ever present caution to the careful; but as a matter of fact there have been very few such occurrences.

We cannot but think therefore that it would be unfortunate if any attempt were made, because of this judgment or otherwise, to bring the two platforms together much closer than they are now. A curious evidence that it is in fact about the right thing may be found in the fact that most of the elevators in the city do not approach the floors within 2 or 3 ins., although in them most of the causes of variation which affect the elevated cars are absent. Again, the two New York lines were independently constructed, yet each was given about the same gap of 4½ ins. complained of, and the same, we believe, is the case with the Brooklyn lines. There are sound reasons for this, despite the fact that occasionally an accident results which might have been saved —or might not—had the gap been narrower. After all, it must always involve a great element of carelessness for a passenger to stumble over either a 4-in. or 1-in. gap between two platforms nearly flush with each other, and if such platforms with the wider gap are a just provocation of accident, what must be said for the ordinary arrangements of ordinary railways?

The Weakness of Traffic Associations.

The commissioners of the various traffic associations seem to be having a rather hard time just now. Their lot, generally speaking, is "not a happy one"; for the companies whom they serve are apt to be each convinced that the commissioner is partial toward its rivals and severe toward itself in detecting and punishing its infraction of rules, while the public insists upon regarding the associations in the same unfavorable light that it does the manufacturing trusts and the combinations in trade.

In the Trunk Line Association, what with the dressed beef war, the slaughter in other freight rates which followed it, the immigrant rate war, and the payment of ticket commissions, matters are coming to a sorry state. Commissioner FINK is still abroad on his vacation, seeking rest from the "wars and rumors of wars", which occupy his time when at home. Passenger Commissioner PIERSON, who is filling Mr. FINK'S place, became disgusted at the results of his fruitless attempt to bring order out of chaos and went on a yachting excursion. It is strongly suspected that the days of the Association are numbered, and that it will be dissolved by mutual consent if it does not fall to pieces before that can happen. One thing which is said to be precipitating its downfall is the loss which the trunk lines are experiencing on immigrant business. When the New York—Chicago rates were cut to $5.00 a few weeks ago, it was expected that the Western lines would make similar reductions, and orders were called to book through passengers accordingly. But all the lines west of St. Louis and Chicago have now refused to make the requested reductions, and the prices received for the tickets already sold are, in some instances, actually less than the amount which must be paid the connecting line. The expense of maintaining the Association is said to be over $200,000 per year; and if the inefficiency of the past few months is to continue, it is generally conceded that the benefit received is largely imaginary.

The new tariff recently adopted by the Transcontinental Association was expected to work wonders. But Chicago threw her powerful influence against it; the lines running west from Chicago and the Trunk lines have refused to accept it without material modification and the chances of its being put in force seem to be small.

The International Association, which is the successor to the Texas Traffic Association, has encountered a snag in its efforts to enforce its rulings. At a meeting held last month in Chicago, it was voted to increase the differential rate; and the managers of the Queen & Crescent system were notified that unless they acceded to this, freight from their connecting lines, the Vicksburg, Shreveport & Pacific and the Vicksburg & Meridian, would be refused, except on prepayment of full local rates. The Queen & Crescent managers did refuse to accede to this, and secured an order from the Court under whose jurisdiction the Texas & Pacific, one of the principal members of the International Association, now is, directing the Receiver to treat the connecting lines belonging to the Queen & Crescent system in every respect as lines of other systems were treated, without partiality or preference.

Nor does harmony seem to be more prevalent elsewhere. The Santa Fé, St. Louis & San Francisco, Rock Island, and Missouri Pacific are having a sanguinary war on cattle rates from the Southwest to Kansas City, St. Louis and Chicago. In the Northwest a war in passenger rates has just been narrowly escaped; and the prospect that freight rates will be advanced soon seems to remain a prospect and nothing more.

It is undoubtedly true that the blame for the weakness and inefficiency of the traffic associations is justly laid upon that clause of the Interstate Commerce law which prohibits the pooling of competitive traffic. The associations in the eyes of the law are combinations to limit competition, and all their compacts and agreements are outside the pale of its protection and will not be enforced by the courts. Whatever is done must be done by the free will of each member of the Association and there is no redress at law if agreements are repudiated or broken as soon as made. Formerly, in the days of pooling, the Commissioner had it in his power to enforce ample pecuniary penalty for infractions of discipline; but with pools prohibited, the power of the organization is extremely limited. The penalties inflicted can only be those to which the members will voluntarily submit.

Evidently if traffic rates are to be cut on every hand without regard to the rulings of the Commission, that body may as well be dispensed with, and so much expense be saved. It is toward that position, we are sorry to say, that a tendency seems to exist. Railway managers seem to be possessed with the idea that the way to earn dividends for their stockholders is to steal their rivals' trade by cutting rates. The natural results of this policy, when unrestrained by some form of mutual agreement, are too plain to need pointing out. If it is really undertaken to remedy the inefficiency of the present commissions by their abolition, it will be found that a remedy has been chosen of which a little goes a great way. A short experience will doubtless convince the owners of the roads, if it does not the managers, that in order to have any profits from the operation of competing roads, there must be some form of coöperation and mutual understanding to secure uniform and equitable rates. The pertinent question is not whether there shall be this coöperation, but what form it shall take to ensure the best efficiency. If in their compacts for mutual coöperation, railways are deprived of the protection of the law, they must make their own law and see to it that their sense of honor and mutual obligation is such that the compacts and agreements shall be sacredly kept. This is at present their only resource. Perhaps the time will come when it will be recognized that the transportation interests of the country are entitled to equal protection with other industries. The laws innumerable which are now enacted by State and nation to prevent railways from making undue profits will be supplemented by laws to protect them from losses. "Just and equitable rates" is a phrase of railway legislators. But are rates just and equitable which do not repay the railway for the actual cost of transportation? The true solution of this railway problem will come about not by independent action but by harmonious coöperation, supplemented and sanctioned by the regulations of the State.

The Fate of the Great Log Raft.

The monthly Pilot Charts of the Navy Department are always interesting to study, and are no doubt all of them of the greatest value to mariners, but the supplementary chart for August contains some curious evidence of more general interest as to the fate of the great Leary log raft, which was abandoned and broke up about 200 miles E.S.E. of New York, Dec. 18, 1887. It appears by a long list given on the chart that the logs have been "spoken" 143 times since, by different vessels, a result which would not be so surprising if the logs had remained near their original location, but they have not. They have been drifting steadily eastward and slightly southerly, in quite a different course from the prevailing ocean currents, and the great bulk of them are now in lat. 36° N., long. 46° W., having started from lat. 40° N., long. 70° W. On June 29 last some of them reached the Azores in long. 28° W., and many have been seen both north and south of the Azores nearly as far east. Since March 17 hardly any logs have been seen west of long. 60°, 10° east of where they were abandoned, and since April 23 few west of long. 50°. There appear now to be more or less of them floating about over an enormous area, extending over 20° east and west, and about 8° north and south, and the great bulk of the recorded encounters with them are within the limits so defined.

When we consider how small an object a log is in the ocean, how trifling the number of logs compared with the vast area over which they have to be scattered, and how still more trifling the number of ships, even in this frequented sea (considerably south, however, of the beaten path between New York and Liverpool),nothing can give one a more vivid idea of the activity of modern commerce than this record of the encounters of logs and ships on this vast area.

To be sure the raft was originally a large one. It consisted of about 27,000 trunks of trees, 50 to 100 ft. long, and bound together with chains and withes into a huge cigar-shaped raft, 500 ft. long, 65 ft. wide and 38 ft. deep, drawing 19½ ft. of water and having an estimated weight of 11,000 tons. The raft was towed in ten days from Port Joggins, Nova Scotia, to the point of abandonment, and it is perhaps fortunate that the first experiment failed, or we should have had more and larger rafts following to cause still greater danger. The recent success of a later and different attempt, in which the logs were bound together in the form of a ship, we have already recorded. A 15-in hawser was used in towing, but after having weathered several gales successfully a hurricane struck it Dec. 18, and it had to be abandoned in the very track of commerce. Great excitement ensued in New York, and several vessels were at once sent out in search of the raft, which was found 6 days later, broken up, 100 miles from the point where it was abandoned.

Some of the paths of derelict vessels on these charts are even more curious than the paths of the logs. Thus the schooner "Twenty-one Friends" was abandoned off Norfolk, Va., March 24, 1885. In 250 days (8 mos. 10 days) she had drifted 3,525 miles into the Bay of Biscay, just north of Spain, having been encountered in this journey by 22 vessels. In 4½ mos. (135 days) she drifted 2,130 miles. Considering that Columbus was 70 days in making his voyage of not many more than 3,500 miles, this must be considered pretty lively drifting, yet it is paralleled by many other examples on the chart. For instance a buoy from off Newfoundland drifted 970 miles in 46 days in almost a straight line,to near Cape Cod. Fortunately, most of the derelicts tend to drift S. E., out of the most crowded seas.

Here we may note that the proof-reading of the Hydrographic Office seems to be somewhat defective. Thus, the "Twenty-one Friends" is shown on the chart in a position for Dec. 4, 1886, which the accompanying text (as well as probabilities) gives as Dec. 4, 1885. Still worse, the point where the great raft was abandoned is given as latitude 46° 16′ N., longitude 70° 06′ W." The point thus located is on decidedly dry land, being in the neighborhood of the White Mountains. The true latitude, undoubtedly, was 40° 16′ N. No great confusion was likely to result in this particular instance, but it is evident that very serious consequences might result from such misprints in cases, and as these two were the only ones of the many records on the chart, which we had occasion to examine closely, it shakes one's confidence a little to find them wrong. In fact, not to put too fine a point upon it, it shows the most reprehensible carelessness on the part of some person or persons connected with the office.

An English Railway Manual.

Bradshaw's "Railway Manual" is, in a rather small way, for English railway men, what Poor's "Railway Manual" is for American railway men, but so much matter is crowded into a comparatively small book, and this matter has been so much pruned and curtailed and is so meagre, in order to maintain the size of the volume uniform with that of ten years ago, that the value of the book is very seriously impaired. The scope of the work is confined mainly to historical and financial matters, working arrangements and some statistics. We have before us the volume for 1888, and some description of it may interest our readers. The book is 7 ins. × 4½ ins., with 624 pages of reading matter and a few pages of advertising, and has three folding maps, Great Britain, India and Europe. The type is unpleasantly small and crowded, so that a seeker after information is soon tired of his work. The price is $2.88.

The first part, 347 pages, is devoted to the railways of the United Kingdom, giving their history, length, capital, financial conditions, traffic and working arrangements, etc., and a list of principal officers. There are no particulars as to the track or equipment, and no mention of gauge, except in the case of narrow-gauge lines, and in the pages devoted to the Great Western Railway no note is made of the 7-feet gauge and there is no clue as to how many miles of this system still retain the broad or the mixed gauge, or how many miles have been altered or built to standard gauge. A few lines are given to each branch and acquired road, but it must be exasperating for a man who wants to find certain information to be constantly running against a snag in the shape of a note referring him "for other details", to a Manual of several years previous.

Part 2, 32 pages, is devoted to continental railways, and a note informs the reader that much useful information will be found in the Manual of 1877 and previous editions. A few of the principal lines are dealt with in the same manner as the English lines.

Part 3, 156 pages, is devoted to Colonial, Indian, American, and other railways. The information in this part is generally of a vague description. Several pages are given to Government statistics of Indian railways, and details of the principal lines are given as fully as those of the English lines. A good deal of miscellaneous information is given of the New Zealand lines. The railways of the Australian colonies, however, are dismissed with a few notes and figures, but no mention is made of the route or length of the several lines, and anyone who would expect to be able to gather from this Manual some intelligent idea as to the extent and conditions of railways in these colonies, would be very much disappointed. The principal Canadian lines are treated more fully, but it is very surprising to find no mention made of the Canadian Pacific extension across the State of Maine, which is a very important link in this transcontinental line. Some of the principal lines of South America and two Mexican lines (the Mexican Ry. and Mexican Central Ry.) are given in the next 32 pages, and the remaining 147 pages are devoted to some railways of the United States in which British investors are interested. This division starts with a table of railway mileage of the United States for each year from 1827 to 1886 inclusive. In the compilation of data relating to American lines, the editor of the Manual seems to have taken no particular pains to procure accurate information or to keep track of those changes and developments in which American railway matters differ so signally from those of the conservative and established English systems. Here and there we find statistics taken from reports of several years ago, because, to quote the editor's note, "No recent returns have been received for publication." Then in the case of the Baltimore & Potomac, the tunnel at Baltimore, 6,969 ft. long, is described comparatively in detail, but the only information obtainable as to the New York, West Shore & Buffalo consists of a few figures from the report for 1884, because "no recent returns have been received", and as no mention is made of this line under the heading of the New York Central & Hudson River, except the item of "Stock, West Shore (nominal value), $1,000", in the list of assets, we presume the editor never learned of the great "deal" by which the latter road acquired the former, giving the Vanderbilt system the monopoly of the Hudson river traffic. The Pennsylvania is not mentioned as reaching east of Philadelphia. The Philadelphia & Reading system is said to comprise a certain number of miles, but where or what they are is not stated, and the only clue to the location of the entire system is the mention of Philadelphia and New Jersey. Finally, two pages are devoted to the West Indies.

Part 4 is devoted to canals, and gives a brief statement and list of officers of several canals in Great Britain, 24 being mentioned.

Part 5 gives similar information as to "Auxiliary Associations", principally car works.

An appendix gives some Parliamentary papers as to financial matters, also the report of the Railway Commissioners for 1886, and some summarized statistics. A certain Convention of Railroad Commissioners of the United States, is also mentioned, but this is not of particular value as the Convention alluded to is that of 1879; but the searcher is referred to previous manuals for further particulars. Then there is a list of brief notices of the projects for 1888, a list of dividends of the principal companies from the earliest periods, a directory of railway officials and some miscellaneous discount tables, etc.

The principal defect of the book is the parsimonious endeavor to crowd too much information into a limited space. With one volume printed in good type, devoted exclusively to railways, canals, and general information relating thereto, of the United Kingdom, and another volume devoted to foreign enterprises, the result would be that the information could be extended to be of more practical and general interest. The omission of particulars as

to gauge, track, equipment, etc., and other practical matters, is a serious defect, and should an American accustomed to Poor's "Manual," turn to Bradshaw's "Manual" for information respecting foreign roads, he would be likely to draw comparisons decidedly unfavorable to the latter. By adopting this compressed "Manual," the publishers, in trying to economize, lose all chance of remunerative advertising, as there is only room for a few pages of advertisments. The book is useful in its way, mainly to financial men, and is better than no manual at all, but it must, we should think, be a very trying work to study, especially for the British investors who are interested in foreign railroads, and they are legion.

PERSONAL.

ROBERT HARRIS, President of the Northern Pacific, will resign his position, and Vice President T. F. OAKES, will succeed him. Mr. HARRIS, will be Chairman of the Board of Directors. JOHN C. BULLITT, of Philadelphia, will enter the directorate to succeed AUGUST BELMONT, resigned.

THOMAS W. BURROWS, Superintendent of the Indianapolis & St. Louis Ry., of the Bee Line, has been appointed Superintendent of the Chicago & Atlantic.

M. W. ROBINSON has been appointed to succeed G. A. ROSE as Roadmaster of the Chicago, Burlington & Quincy at Burlington, Ia.

CORNELIUS LYNDE, President of the Rock Island & Peoria, and a director of the Burlington, Cedar Rapids & Northern, died recently at Rock Island, Ill.

Sir JOHN HAWKSLEY, who has been in litigation with the Liverpool Corporation for some years over his fees for preparing the plans for the Liverpool waterworks, has been awarded every penny of his claims, with costs to be paid by the Corporation.

WM. BRADBURN is the engineer in charge of the construction of the Belt Line railway at Shreveport, La.

W. G. WILLIAMSON, of Montgomery, Ala., has resigned his position as City Engineer of that place.

A. C. KNAPP, formerly Superintendent of the Southwestern division of the Georgia Central, has been appointed Traffic Manager of the Georgia Southern & Florida.

CHARLES WEBER has been appointed City Engineer of East St. Louis, Ill.

Dr. W. L. BALDWIN, who died recently at Jacksonville, Fla., studied civil engineering at the Rensselaer Polytechnic Institute, Troy, N. Y., some years ago, but finally entered the medical profession.

H. I. MILLER has been appointed Superintendent of the Third division of the Chicago, St. Louis & Pittsburg road. The division extends from Red Bank to Logansport, Ind., and includes the Cincinnati & Richmond (Red Bank to Hamilton), Cincinnati, Richmond & Chicago (Hamilton to Richmond), and Chicago, St. Louis & Pittsburg, from Richmond to Logansport.

The Louisville & Nashville R. R. Co. has cut up the long South and North Alabama division into three sections. S. G. RICE is Trainmaster of the line from Birmingham to Decatur, with office at Birmingham; J. J. KINNEY is Trainmaster of the Birmingham Mineral, with office at Bessemer; L. W. CANTS is Trainmaster of the line from Birmingham to Montgomery, with office at Birmingham.

It is reported that E. B. THOMAS, Vice President of the New York, Pennsylvania & Ohio, is to be Second Vice-President of the New York, Lake Erie & Western.

RICHARD A. PROCTOR, the English astronomer and popular writer and lecturer on astronomy, died of yellow fever in the Willard Parker Hospital, in New York, on Sept. 12. Mr. PROCTOR was born at Chelsea, England, on March 23, 1837; entered Kings College in 1855 and received his degree from St. John's College, Cambridge, in 1860. He is best known by his popular writings on astronomy and by his wonderfully entertaining and instructive lectures on that subject. Mr. PROCTOR first came to the United States in 1873, and several years ago, after the death of his first wife, he married an American lady and expressed his intention of becoming a citizen of the United States. He had a home and an observatory near Orange Lake, Marion Co., Florida, and has lived there for some time past for the benefit of his health. When he died he was on his way to England to meet lecture engagements, and is supposed to have contracted his disease in passing through the infected region of Florida.

CORRESPONDENCE.

High Masonry Dams.

NEW YORK, Aug. 27, 1888.

EDITOR ENGINEERING NEWS:

In order to give greater generality to my equation upon High Masonry Dams, I beg leave to submit the following modifications:

Instead of making the length of the joint, $l_1 = 2u + x$, let $l = u_1 + u + x = (b+1)\ u = a\,u + x$; $u_1 = b\,u$, being the distance of the projection of the center of gravity of the weight upon the joint, from the up-stream end of that joint when the reservoir is empty, all other quantities being used in the sense already defined.

In precisely the same manner as the other equations for equal values of u_1 were obtained, we find, for unequal values of w, or u_1 and u the following equations, viz.:

$$p = \frac{[4\,(A\,a+1) - 6\,A]}{u\,(a\,A+1)^2}\,W\,A \qquad (a)$$

$$W = \frac{p\,u\,(a\,A+1)^2}{A\,[4\,(a\,A+1) - 6\,A} \qquad (b)$$

$$u = \frac{[4\,(a\,A+1) - 6\,A]}{2000\,p\,(a\,A+1)^2}\,W \qquad (c)$$

$$u = \sqrt{\frac{10{,}41\tfrac{2}{3}\,h^3\,[4\,(a\,A+1) - 6\,A]}{2{,}000\,p}}\ \frac{A}{a\,A+1} \qquad (d)$$

If, in these equations we make $a = 2$, they become identical with equations 1, 2, 3 and 4, as published in your issue of the 11th inst.

If we assume any given pressure for the down-stream end of the joint or base, the pressure upon the up-stream end may be had by substituting u_1 for u in equation (a).

ISAAC MORLEY, C. E.

The Highest Bronze Statue.

Billings, Clarke's Fork & Cooke City R.R. Co.

BILLINGS, Mont., Sept. 4, 1888.

EDITOR ENGINEERING NEWS:

In your edition of the 1st. inst., commenting upon the proposed statue of WILLIAM PENN, 37 ft. high, you name as the bronze statue next in height to it that of ARMINIUS or HERRMAN in the Teutoburg Forest with a height of 34 ft. This is erroneous. The one next in height to that of WM. PENN is that of HERCULES, surmounting the cascades in the Park of WILHELMSHOCHE near Hesse-Cassel, which from top of the head to the soles of the feet measures 36 ft. The original one was chiseled out of stone, but was dislodged by an earthquake shock and lies westerly of the present one. During the glorious days of "Immer Lustig," as JEROME BONAPARTE was called, who was then King of Westphalia with the capital at Cassel, the present one was substituted for its "rocky" predecessor. It was cast of copper somewhere between 1807 and 1844 by one HENSCHEL, and is provided on its inside with iron ladders by means of which the statue proper as, also the slab upon which he(Hercules) rests, are accessible, affording an excellent view over the surrounding mountains.

Not being able to give the exact altitude at present, suffice it to say, that this statue is on the highest point of the range of mountains called "Habichts Wald," a southern extension of the Teutoburg Forest.

M. H. W. BOONE.

The Relation of Railways to Forest Supplies and Forestry.

In a paper entitled as above in Bulletin No. 1. Forestry Division, Department of Agriculture, Mr. M. G. KERN first gives a brief history of the growth of railways in this country, which began in 1830, reached a mileage of 2,975 miles in 1840, and had increased to 9,021 miles in 1850. That year may be regarded as the beginning of the second epoch of railway building, as the first grants of public lands were then made in aid of the railways, which had previously been constructed without either State or National assistance.

A summary of the grants of public lands shows that 78 roads have been aided in this way, the total acreage involved being 197,203,808 acres, only 5,000,000 acres less than the entire area of the original 13 States. On May 1, 1887, there were, completed and in operation, 17,978 miles of land grant roads. Under the impetus thus given to railway construction the mileage, increased to 30,635 in 1860, 52,914 miles in 1870, 93,349 miles in 1880, and fully 152,000 miles at the present time. A careful comparison of the length of roads and the length of tracks warrants the addition of about 25 per cent. to the reported mileage of roads to give the mileage of railway track actually laid.

Assuming that there are 187,500 miles of track in the United States, and that one tie is required every 2 ft. the total number of ties in use would be 495,000,000. The average volume of each tie is 3 cu. ft.; therefore, 1,485,000,000 cu. ft. of timber are at present actually embedded and undergoing decay on the railways of the U. S. While the amount of bridge and trestle timber in use cannot be accurately determined, an average of 2,000 cu. ft. per mile is considered approximately correct by engineers. This gives a total of 375,000,000 cu. ft. for bridge and trestle work.

These two items, or track construction proper, therefore amount to 1,860,000,000 cu. ft. of timber in actual use. Assuming that every cubic foot ready for use requires 1⅔ cu. ft. of round timber, we get for the amount of round timber necessary to yield the above required amount, 3,100,000,000 cu. ft.

The number of telegraph poles in use can safely be estimated at 5,000,000; each pole contains 10 cu. ft., making the total thus used 50,000,000 cu. ft. of timber. In consideration of the steady increase of mileage during the last decade, it is safe to anticipate a yearly addition of 5,000 miles of track, requiring 13,200,000 ties, 10,000,000 cu. ft. of bridge and trestle timber and corresponding amounts of construction timber and poles. To this may appropriately be added a very large amount, incapable of exact estimate, used in fencing the roads, together with timber incidentally employed for track construction.

Maintenance requirements vary so much with local conditions, that an accurate estimate is impossible. Assuming that hard wood ties last seven years and soft wood ties four years, and that bridge and trestle timber and telegraph poles last ten years, we have the following approximation:

	Cubic feet.
70,714,286, ties	212,142,858
Bridge and trestle timber	37,500,000
Telegraph poles, 500,000	5,000,000
Total demand for maintenance	254,642,858

To this must be added the amount of material required for the construction of new roads, assumed above at 5,000 miles annually being:

	Cubic feet.
13,200,000 ties	39,600,000
Bridge and trestle timber	10,000,000
150,000, telegraph poles	1,500,000
Total	51,100,000
Demands for maintenance	254,642,858
Demands for new construction	51,100,000
Total	305,712,858

which may safely be considered as equal to 509,521,430 cu. ft. of round timber.

Assuming an average yield of 300 ties per acre, the 70,714,286 ties demanded annually for the maintenance of the present mileage would require a forest area of 235,714 acres, and 5,000 miles of new road annually built would require 44,000 acres, thus giving the area stripped of its timber every ten years as 2,797,140 acres. But 300 ties per acre is a very high estimate; assuming the more common average of 100 ties per acre, the necessary area for ten years would be 8,391,420 acres.

Assuming an average yield per acre of 3,000 cu. ft. of "dimension" timber together with 500 telegraph poles, we find that these two items require 13,500 acres; adding the area necessary for ties, 235, 714 acres, we have 249,214 acres for maintenance. Estimated in the same way, the annual new construction requires 47, 663 acres, therefore the total annual requirement is 296,847 acres.

According to Mr. FERNOW, a yearly average production of 50 cu. ft. of timber per acre for large areas, with a long period of time and tolerably well-stocked forest, can be assumed as possible. From this it would appear, that to supply continuously the present demand of wood for railway construction would necessitate a reserve of not less than 10,000,000 acres of well-stocked thrifty forest.

The speed and weight of railway traffic, and the necessity of imbedding the ties, thereby inducing decomposition, demand unconditionally the best and most durable timber attainable. This demand occasions great waste throughout, an instance of which is the cutting annually of millions of young white oak trees, each of which will make but one tie.

Concerning the adequacy of the supply Mr. KERN says that ties are largely supplied by farmers during a season which would otherwise be unoccupied, and that on this account an abundance of material is steadily offered, and no advance in price has been made.

Aside from the railway supply, however, a notable diminution of forest wealth is beginning to be felt by many industries depending for raw material on certain valuable kinds of timber. Approaching scarcity is plainly indicated by steadily advancing prices, and by the difficulty already experienced in the manufacturing centers of obtaining the desired materials. Railway managers acknowledge that the present condition of the supply cannot last for an indefinite period, as many leading centers of production are now practically exhausted, necessitating transportation over far greater distance than heretofore.

Substitutes for wood in railway construction have already become a subject of great interest to the railway world; various other expedients have also been discussed for relieving the pressure on the valuable forest products. The adoption of some means of preservation by which many kinds of timber hitherto rejected, and therefore still abundant, may be made available, has already been much experimented with. An instance of its successful adoption is shown by the use of beech ties in Europe, their life being increased by the application of an antiseptic, from 6 to 12 years.

Timber culture is another means of providing railway needs. A circular was issued in 1886 and was directed chiefly to the railway companies in the western part of the United States, for the purpose of ascertaining the consumption of timber by the railways, and to learn what efforts, if any, had been made toward tree culture. Concerning the present condition of things, as indicated by the correspondence resulting, Mr. KERN says:

> To sum up briefly the results of the agitation in favor of timber culture by railway companies, it can be stated that, while the imperative necessity of such a movement is freely acknowledged by those best informed in regard to the demands of the present and the outlook of the future, little disposition on the part of the railway companies to enter practically into such an enterprise has so far manifested itself. And it is equally clear that so long as a new departure in forest culture is asked or expected from the heads of the operating service, to whom appeals have in greater part been made, no enterprise on a scale even distantly proportioned to the magnitude of the issue can reasonably be expected, and this mainly from the fact that the service must be managed in accordance with conditions existing for the time being and as they will appear on the yearly balance-sheet of every corporation. Present expediency and restriction of expenditures outweighs, therefore, all possible advantages of the certain future.
>
> The managers of various leading railways, especially those of the Western Plains, formerly called the "Great American Desert," have accorded liberal encouragement to the tree culture and home forestry, by establishing experimental stations and nurseries in various sections of their lines, designed to show the possibility of tree culture, to attract settlement, and in consequence to promote the sale of lands granted to them by the Government. As soon as those objects were successfully accomplished the companies withdrew from this inviting field of arboriculture, leaving it to the energy of the settler.

In conclusion, Mr. KERN says that the time cannot be far distant when the attention of capitalists investing so lavishly in railway properties will be directed towards a closer investigation of this financial question, and when once convinced of the feasibility of timber culture from a financial point of view, the step towards action will quickly be taken.

Railway corporations are deeply interested in the perpetuity of suitable material for the maintenance of their thousands of miles of track. The managers of the railways of the sparsely-timbered sections cannot fail to see the advantages to accrue in future years from a general interest in favor of timber culture aroused amongst the owners and tillers of the soil; a foward movement which can be most effectually promoted by making the people of every section along the various lines familiarly acquainted with the value and ease of culture of certain kinds of timber, in which not only the railways, but the people at large, are most prominently interested.

IF all the railroad bridges across the Ohio river that are now contemplated are built, and it seems that a larger portion of them will be, the boats will have little or nothing to do between Louisville and Henderson but to dodge piers. Beside the two at Louisville, there is one proposed to be built at Hawesville for the Indianapolis, Cannelton & Chattanooga Railroad; one at Rockport for the Rockport & Owensboro Railroad; one at Owensboro for the Vincennes, Oakland City & Owensboro Railroad; one at Newburg for the proposed Bowling Green, Hartford & Ohio River Railroad; one four miles above Henderson for the Ohio Valley road; one at Uniontown; one at Paducah for the Chicago & Paducah road, and one at Cairo for the various railroads centering there.

The projectors of these eight bridges are all of the opinion that their scheme will yet prove to be a "certainty", and while some of the enterprises will surely fall through, it is probable that before many years at least six of them will be built, since a good backing is behind all of the projects.—*Louisville Courier Journal.*

PROTECTING WATER IN PIPES FROM FREEZING.—With regard to the letter of our correspondent "J. W.," of Cedar Rapids, Ia., on page 147, in which he stated his intention of making experiments during the coming winter with different methods of protecting water pipes, Messrs. Macan, Pechin & Co., of Philadelphia, Pa., send us a circular descriptive of the "magnesia sectional covering", in which are noted experiments made by Mr. EBERHARD LUTTGEN, with pipe protected with this covering. While water in an unprotected pipe froze solid, that in a pipe protected with a 2-in. covering did not freeze, although the temperature fell from 30° F. to 4° F. during the time of test. The pipes were of iron, 2 ins. diameter and 35 ins. long.

THE *Great Eastern* was beached at New Ferry on the Mersey three weeks ago. The original intention was to break her up, but it is now said that unsuspected value has been discovered in her, and the plans may be changed. The sum paid for her was $100,000 and it will cost about the same amount to break her up; but the owners anticipate handsome profits.

PUBLICATIONS RECEIVED.

Building Stone in the State of New York. By JOHN C. SMOCK. Bulletin of the N. Y. State Museum of Natural History, No. 3, March, 1888. Printed for the Museum.

The 146 pages of this bulletin are devoted to an exhibit of what is called the economic geology of New York. The various rocks useful for building purposes are located geologically and geographically and described in detail. The conclusion is in the form of descriptive notes of quarry districts and quarries.

Proceedings of the Engineer's Club of Philadelphia. Vol. VI, No. 4; Feb. 1888.

This number contains the following papers: "Some Notes on Railroad Construction which may be of Use to Assistant Engineers," by THEODORE LOW; "The Gileppe Dam" and "The Plan Formation of the Quaker Bridge Dam," by A. MARICHAL. Also notes on "Efficiency of Different Forms of Boilers in Use by the Philadelphia Water Department," and "Analogies between Electrical and Mechanical Units and Phenomena." There are also the annual address of the retiring President, THOMAS M. CLEEMANN; the opening address of the President, JOSEPH M. WILSON; the annual report of the Secretary and Treasurer; abstracts of minutes of meetings, and a portrait of THOMAS M. CLEEMANN.

Journal of the New England Water-Works Association. Vol. 3, No. 1. September, 1885. (Issued quarterly). Price $2 per year; 75 cts. per number. Published by the Board of Editors, New London, Conn.

The following papers are given, with the discussions thereon: "High Water Alarm for Reservoirs and Tanks," by W. P. WHITTEMORE, Supt. of Water-Works, North Attleboro, Mass.; "Can Tests by Tubular Wells be Relied upon to Show the Amount of Water that may be obtained for a Public Water Supply," by W. C. BOYCE, C. E., of Worcester, Mass.; "Soils from which Water Supply may be Drawn by Filter Galleries or Driven Wells," by PHINEAS BALL, C. E., of Worcester, Mass.; "The Aeration of Water Supplies by Natural Canals and Low Dams," by STEPHEN E. BABCOCK, C. E., of Little Falls, N. Y., "Covered Reservoirs," by C. H. SWAN, C. E., of Boston, Mass.; "The Use of Relief or Safety Valves in Water-Works Distribution Systems," by STEPHEN E. BABCOCK, C. E., of Little Falls, N. Y. This number contains also a list of members and the proceedings of the Seventh annual convention.

Poor's Manual of the Railroads of the United States, for 1888, showing their route and mileage, stock, bonds, debts, cost, traffic, earnings, expenses and dividends; their organization and officers. New York: H. V. & H. W. POOR, $5,00. pp. 1,323.

We noticed the introduction to this invaluable manual so fully last week, and its general features are now so well known to all interested, that it is hardly necessary to say more than this edition appears to be fully up to and beyond the standard of its predecessors.

An Index to Engineering Periodicals, 1883 to 1887 inclusive. By FRANCIS E. GALLOUPE, M. E. Boston, 30 Kilby St.; New York, Engineering News Publishing Co. 294 pp. Price $2.00.

The progress in developing material resources, in recent years, has created a vast amount of engineering literature, which is scattered through the various engineering journals. To render a large amount of this available, has been Mr. GALLOUPE'S task, who has sought, in a handy little volume containing about 10,000 references, to cover the contents of the leading journals during the past 5 years. The matter seems to be arranged admirably under topics. The book will certainly serve a purpose with all interested.—*Science.*

SOCIETY PROCEEDINGS.

National Exchange Telephone Association.—Three papers of general interest to engineers, read at the convention of this Association, held last week in New York, were the following, in addition to which there was a long list of papers dealing with the more technical details of telephone practice. The convention was a well attended and successful one.

MR. W. D. SARGENT, of Brooklyn, in discussing "Underground Work in Brooklyn", said the extension of underground construction has been restricted to building connecting conduits. The conduits have been mainly made of creosoted wood. The first section of the creosoted wooden conduits have been in use for four years, and there has been no evidence of decay, and they remain clean and dry. The manholes are a most important part of the work, and we have to rebuild a number of them. We have found that the creosoted wood method of building conduits is the best that can be employed. We have used nothing but the lead-covered cable for the past four years. This lead is mixed with a small percentage of tin, and has been very satisfactory. The cables in use for the past year showed some induction, but not enough to make the cross-talk objectionable. The longest cable in use in Brooklyn is 11,800 ft., and the cross-talk is very slight and of little account.

"During the past year a special cable has been made for trunk lines, and two miles of it have been put up on the elevated roads. This cable gives better service than the one underground. The result is that the increase in the weight of the copper in the new cable, as well as the better insulation of the wires, is a step in the right direction, and we think that this type of cable will be the best one for use in the underground system. Up to this time there has been no serious accident in the construction of the underground system, either from explosion of gas or from foul air. There is no doubt but that one reason for this is that there is less gas in the streets of Brooklyn than in other cities, and further we have taken every care possible to protect the workmen. The cost of the underground system increases as the mileage does, and this will be decreased and the services made more efficient when a return is made to the metallic circuit. The condition of the underground service in Brooklyn, Sept. 1, was as follows:

Conduit laid	15.17 miles.
Single duct laid	105.05 "
Cable in subways	22.93 "
Single conductors in subways	2,053.03 "

There are 1,913 subscribers using underground wires, which are 1,229.9 miles in length.

MR. LEONARD F. BECKWITH, in a paper on the New York subways, said that the subways had been laid under the direction of the Board of Electrical Control. He spoke of the methods of laying the subways, and said that the question of distribution had largely been left to the different companies to experiment with, and as yet little had been done. They had made a few efforts, but had done little toward the solution of the difficulty, and were wasting valuable time. One of the great difficulties of constructing subways in this city was the steam pipes. There were many other things in the way of constructing a successful subway, which were mainly electrical, and these had been left for solution by the companies. In regard to the progress of the work, he said that up to date the number of feet of ducts laid in the city were as follows:

Dorsett system	235,837
Zinc tubes laid in hydraulic cement	68,853
Creosoted wood ducts	167,175
Cement pipe laid in hydraulic cement	216,626
Iron pipe laid in asphaltic cement	131,284
Iron pipe laid in hydraulic cement	1,492,722
Iron distributing pipes	23,301
Edison iron tubes	222,794
Total feet of single duct	**2,489,602**

The number of miles of single duct laid was thus 472 miles in a trench 37 miles long, and 523 manholes had been constructed. Of these ducts, 376 miles were for telephone and telegraph companies, and 96 miles for electric light companies. In these ducts 3,567 miles of telegraph and telephone wires had been laid. The Metropolitan Co. had laid a 100-wire cable from Whitehall St. to 58th St., and the Western Union Co. had laid 100 miles of single wire. The Edison Co. had laid 126 miles. The Brush Electric Light Co. were now engaged in laying a mile of cable containing eight conductors.

Mr. E. F. SHERWOOD, of New York, read a paper on "Telephone Exchanges of New York", largely devoted to statistics and an explanation of the manner in which the Central Office is conducted. He said that the Metropolitan Co. had 7,300 subscribers in this city in 11 exchanges. The largest exchange was 30th St., which had 1,108 subscribers. The new building in Cortlandt St. was nearly ready, and when it was put in use the exchanges would be consolidated there and the expenses reduced $2,700 per month. The trunk lines would all enter the building underground.

Engineers' Club of Kansas City.—A regular meeting was held Sept. 3; T. F. WYNNE in the chair, 16 members and 9 visitors present.

A new cable railway grip was described by its inventor, Mr. HARRIS, and the Secretary read, "A Note on Missouri River Flood Waves", by JOHN F. WALLACE. A letter from Mr. DECOURCEY, referring to shrinkage in embankments, was read and discussed.

WALTER CLARK and EDMUND SAXTON were elected as members.

KENNETH ALLEN, *Secretary.*

The Roadmasters' Association of America, at its meeting in Washington this week, laid the reports on standard track joints over until next year, and recommended that trials be made during the ensuing year of the two devices submitted. A number of reports on technical matters were received. The old officers were re-elected for the ensuing year, as follows: President—J. W. CRAIG, of Charleston, S. C.: *First* Vice-President—I. BURNETT, of Joliet, Ill.: Second Vice-President—JAMES SLOAN, of the Chicago & Eastern Railroad; Secretary and Treasurer—W. H. REID, of Waycross, Ga. Sixty new members have been elected during the convention, and over 400 names are now on the rolls of the association.

CONSTRUCTION NEWS.

RAILROADS.

East of Chicago.

Existing Roads.

Portland & Ogdensburg.—By a general order dated Sept. 1, Receiver SAMUEL J. ANDERSON turned over this road to the Maine Central which formally assumed its control. JONAS HAMILTON was appointed Division Superintendent, with headquarters at Portland.

Midland of Indiana.—President H. CRAWFORD appealed to the Supreme Court in the case of certain creditors who sued for the appointment of a Receiver. Bonds were given for the indebtedness of the company, and the Receivership was terminated after ten days duration.

Cleveland & Canton.—The change from narrow to standard gauge of this Ohio road will be made on some Sunday in the first half of November. Work is progressing on the three mile branch which is to connect with the Cleveland & Chagrin Falls Narrow Gauge, recently purchased. This is also to be widened to standard, and will be operated as the Chagrin Falls branch of the Cleveland & Canton. It will probably be open for business about the time that the gauge is changed on the main line.

Northern & Western of New Brunswick.—This company is just marketing in England an issue of 5 per cent bonds to the amount of $1,780,000. The line extends from Gibson to Fredericton, N. B., 116 miles. It is proposed to build branches to develop coal lands adjacent to the line.

Meriden, Waterbury & Connecticut.—Surveys are reported in progress for a branch line to extend from South Meriden *via* Yalesville and Wallingford to New Haven. The enterprise is being pushed by R. Wallace & Sons, of Wallingford, and other manufacturers of Wallingford and Meriden.

Canadian Pacific.—The surveying party locating the extension from London to Windsor, Ont., have reached the latter point, and report a very favorable location for the line.——Considerable difficulty has been met with in sinking the shaft on the Canadian side for the submarine tunnel at Port Huron.

Rochester, Hornellsville & Lackawanna.—This short branch of the Lackawanna & Pittsburg, at Hornellsville, N. Y., has been seized by the Sheriff. The line was completed last January and has been operated since then by the Central Construction Company of New Jersey, which built the road. The finances of the company are said to be in a very demoralized condition.

New York, Ontario & Western.—Grading is in progress on the Wharton Valley Railroad, from New Berlin to Edmeston, N. Y., a distance of 7 miles. It is probable that the line will eventually be pushed on up the valley to Richfield Springs, 18 miles distant.——President FOWLER denies the rumor that the company proposes to build a branch to Carbondale, Pa.

Lehigh Valley.—The recent movement of the Reading toward improved terminal facilities at Allentown, Pa., has aroused the emulation of this company, and a tract of 16 acres has just been purchased by it in that city for a similar improvement.——The new branch from Shenandoah to Mahonoy City, Pa., was opened for traffic on Sept. 10.——Surveys are reported in progress for a line from New Boston to Tamaqua, Pa.

Connecticut River.—This road is being double tracked from Greenfield, Mass., to South Vernon, Vt.

Cornwall & Lebanon.—The final location of the extension from Lebanon to Reading, Pa., is nearly finished and it is expected that contracts for grading will be let so that the work can begin early next season.

New Projects and Surveys.

Davenport.—This company has filed a charter in New York and proposes to construct a railroad from the terminus of the Coopers town & Charlotte Valley Railroad, now nearly completed to Davenport Center, up the Charlottte river to East Davenport, about 3 miles. Among the incorporators are JOHN G. SHERMAN and WM. MCDONALD of Davenport, and E. M. HARRIS of Cooperstown.

Greenwich & New Granville.—Surveys are in progress for this proposed line from Greenwich, N. Y., to Rutland, Vt.

Middletown & Hummelstown.—At a recent meeting of this Pennsylvania company, it was voted to proceed with construction at once. The road will pass through valuable brownstone and limestone lands.

American Midland.—This Indiana company has absorbed the Akron & Ft. Wayne project.

SOUTHERN

Existing Roads.

Louisville, St. Louis & Texas.—Col. J. C. FAWCETT has resigned the Presidency of this Kentucky company and M. V. MCCRACKEN, of New York, has been elected to succeed him.

Col. FAWCETT has been elected to the position of Vice President. This move was made in pursuance of an agreement with the New York parties at the time they undertook the construction of the road that they should have the right to the presidency of the company.

The completion of the road between West Point and Owensboro has been much delayed by the recent heavy rains, but the contractors have now resumed active work at Sinking creek and Otter creek, the present eastern and western termini of the track. The bridge will soon be completed and the work of track laying will in a short time be pushed with vigor, and the gap of 26 miles closed up, making a continuous track from West Point to Owensboro.

Columbia, Newberry & Laurens.—This South Carolina road has been graded from Columbia to a point in Lexington County 22 miles from Columbia and 12¼ miles from Newberry C. H. The last of the 15 granite piers for the bridge across Broad river, opposite Columbia is being completed, as is the mile of grading from the river to the terminus. Work will be pushed, and it is expected that the road will be completed and open to Newberry early next spring. As the road is completed, the property will be bonded at the rate of $12,000 a mile. The work so far has been done without the use of one of the mortgage bonds. It has cost $75,000, and $50,000 in township bonds are on hand to pay for the rest of the grading. The construction of the bridge will probably begin early next month.

South Atlantic & Ohio.—The contract for completing this line to Big Stone Gap, Va., a distance of about 25 miles from its present terminus, is to be let at an early date. W. F. GORDON, Bristol, Tenn., is Chief Engineer.

Savannah, Florida & Western.—On the branch which is under construction from Thomasville, Ga., south to Tallahassee and Monticello, Fla., tracklaying is nearly completed, and the line will be open for business sometime this month.

Cumberland Valley.—The contract will be awarded at Chambersburg, Pa., September 18, for building the extension from Martinsburg to Winchester, Va., a distance of 32 miles.

West Virginia Central & Pittsburg.—About 1,500 hands are grading the extension of this road in eastern West Virginia. The final survey is nearly finished on the division between Montrose and Headsville. Trains are now running to Hendricks.

Cape Fear & Yadkin Valley.—On the extension from Fayetteville to Wilmington, N. C., about 8 miles have been graded on each end. An iron bridge 630 ft. in length is to be built across the Cape Fear river at Fayetteville. New rails are to be laid between Greensboro and Winston.

East Tennessee, Virginia & Georgia.—Officials of the East Tennessee, Virginia & Georgia Railroad do not either confirm or deny the report published in several newspapers to the effect that the Kentucky Central will pass into its hands, Jan. 1, 1889. It is a well-known fact, however, that the Brice-Thomas syndicate owns a large block, if not a majority, of the Kansas Central preferred stock. If the report be true the East Tennessee people will probably build from Jellico, Tenn., to Livingston, Ky., a distance of 60 miles, making a great trunk line from Cincinnati to Brunswick, Ga., and Mobile, Ala.—N. Y. *Times.*

Augusta & Chattanooga.—According to the Chattanooga *Times*, there is some prospect that this defunct enterprise will be once more taken up. The line would be about 210 miles in length. A considerable sum was expended last season on the surveys, and some progress was made on the grading.

Central Railroad of Georgia.—The extension from Blakely, Ga., to Columbia, Ala., a distance of 13 miles, was opened for business on September 4. The bridge across the Chattahoochee river will not be completed before November; but a ferry transfer will be made until that time.——The Montgomery *Advertiser*, in an interview with President ALEXANDER, quotes him as of the opinion that the extension of the Cincinnati, Selma & Mobile, from Akron, Ala., to Aberdeen, Miss, will be put through before a great while.

Durham & Northern.—Trains are now running between Henderson and Durham, N. C., over this road. The distance is about 40 miles.

New Projects and Surveys.

Uniontown, Newbern & Southwestern.—

UNIONTOWN, Ala., Sept. 3, 1888.

EDITOR ENGINEERING NEWS:

The Uniontown, Newbern & Southwestern Railroad will begin at Newbern and run *via* Uniontown to the mouth of the Beaver Creek valley, and thence to the Bigbee river, a total distance of 52 miles. Surveys have been completed and a profile and estimate furnished. Grades are generally light and there are few curves. There will be one trestle 900 ft. in length. The road is projected in the interest especially of Uniontown, and will do a general traffic business. Almost every one along the route gives the right of way, and subscriptions have been secured to the amount of nearly $50,000, partly in lands, but principally in cash. No attempt has been made to secure other capital or to interest existing roads in the enterprise. We have a plan of our own for the construction and do not expect to let the work by contract. We propose to grade at least 15 miles before beginning tracklaying, and hope to have a part of the line finished in time for the next crop. Officers of the company will probably be elected about Oct. 1.

J. C. WELCH.

Tampa & Thonotassa.—

TAMPA, Fla., Aug. 31, 1888.

EDITOR ENGINEERING NEWS:

This railway company was chartered May 29, 1888, and proposes to build a railway from Tampa northeast to Thonotassa Lake, a distance of 15 miles. The country along the line is slightly undulating, heavily timbered, and a fine region for fruit and vegetable culture. Surveys have been made, nearly all the right of way has been obtained, and lands and labor have been donated toward the construction of the road. The road is a local enterprise. All the capital stock has been subscribed and it is believed that it will go through. The date of letting contracts is uncertain, on account of the yellow fever scare, but it is hoped that they will be closed by the spring of 1889, so that the road can be opened for traffic next season. JOHN R. SWINGLEY is Chief Engineer.

LAMONT BAILEY *President.*

Memphis & Knoxville.—

HENDERSON, Tenn., Sept. 4, 1888.

EDITOR ENGINEERING NEWS:

The Memphis & Knoxville Railroad Company was chartered in 1872, and made surveys and graded about 30 miles of roadbed from Bolivar to Henderson, Tenn. The grading west of Henderson was easy; there was only one cut that amounted to much. A new company is now being organized and has obtained the stock, franchises, right of way, roadbed, etc., of the old Memphis & Knoxville, and it is now proposed to complete the work on the old grade and extend the line east, making a total length of about 85 miles. The road would give an outlet west for the iron furnaces and ore beds of Wayne and Lawrence counties and would carry a good deal of cotton, lumber, pig iron, and general merchandise between Memphis and the southern counties of Tennessee lying east of Memphis. Right of way has been guaranteed from Bolivar to the Tennessee river; paid up stock has been taken by private parties to the amount of $100,000; and subscription books will soon be reopened and applications made for local aid to the counties along the line. No other capital has yet been secured, but negotiations are now in progress. The Tennessee Midland, the Memphis & Charleston and the Louisville & Nashville companies are aiding the enterprise by many promises, none of which are yet consummated. R. P. NEELY, of Bolivar, Tenn., is President of the company. J. S. WHITE.

Alabama Midland.—It is announced that the capital has been secured for the construction of this road, and J. W. PERSONS of Auburn Ala., has started out from Bambridge, Ga., to make the locating surveys.

Lexington Terminal.—This is a proposed line to run from Lexington, Ga., to Crawford, on the Athens branch of the Georgia railroad, about 3 miles. At the recent election, HAMILTON MCWHORTER was elected President, T. G. LESTER, Secretary, and GEO. C. SMITH, Treasurer. A committee on subscription is at work raising funds for building the road. The directors have put a surveyor in the field to ascertain the probable cost of the line.

Owensboro, West Louisville & Sebree City.—A meeting is to be held on Sept. 15, at Beech Grove, Ky., to organize a company to build a railroad under the above name.

Florence Northern.—Chartered by W. B. WOOD and others of Florence, Ala., to build a railroad from Florence to the Tennessee State line, to connect with the proposed Memphis & Knoxville, mentioned above.

Bluffton & Blakely.—A company has been organized at Bluffton, Ga., to build a railroad to Blakely, about 11 miles. J. J. HAYES, B. C. LYON and J. N. ROGERS, are interested.

Selma & Cahaba Valley.—This Alabama company

has voted to issue $3,000,000 worth of bonds which are to be put on the market by Pierson, Crocker & Co., of New York City. If successful, it is intended to begin work on the line at an early date.

THE NORTHWEST.

Existing Roads.

Fremont, Elkhorn & Missouri Valley.—Two new extensions in Nebraska have just been opened to passenger traffic; the South Platte valley extension from Geneva to Superior, and the extension of the Niobrara branch from Creighton to Verdigris.

St. Paul & Duluth.—The report which has been in circulation that this line was to be added to the Chicago, St. Paul & Kansas City system is denied by the officials of both companies.

Chicago, Burlington & Northern.—It is reported that General Manager A. MANVEL of the St. Paul, Minneapolis & Manitoba, will shortly assume control of this road, which it is rumored is to be run as the Chicago division of the Manitoba system.——The report of earnings for the first 7 months of 1888 shows a decrease of $276,000 compared with the receipts during the same period last year.

Red River Valley.—The last rail on this famous Manitoba road, which by the recent contract is to become part of the Northern Pacific system, was laid at Winnipeg on Sept. 3. Work is actively in progress on the Portage extension.

St. Paul, Minneapolis & Manitoba.—It is reported that negotiations are in progress for a lease of the Emerson branch of the Canadian Pacific. The statement is probably founded on the supposition that the company is especially desirous of competing for the Manitoba traffic with its rival, the Northern Pacific.——On the Eastern Railway of Minnesota, tracklaying has just been completed.

Toledo, St. Louis, & Kansas City.—Another division, 50 miles in length, extending from Eugene, Ind., to Charleston, Ill., 300 miles southwest of the terminus at Toledo, has been widened to standard gauge. With the completion of work on the division between Charleston and East St. Louis, the line will become an important competitor for eastern traffic from St. Louis.

THE SOUTHWEST.

Existing Roads.

Houston & Texas Central.—At the foreclosure sale of this road at Galveston, Tex., the property was purchased by the Central Trust Company of New York, the trustee chosen for the bondholders by its articles of reorganization.

Texas & Pacific.—It is reported that this company intends to begin work soon on a branch line to run from a point about 12 miles from Alexandria, La., extending in a westerly direction into the pineries of Louisiana and joining the main line again at Provencal.

Paris, Marshall & Sabine Pass—This company has just issued bonds to the amount of $1,250,000 bearing interest at 6 per cent. and maturing in 30 years, issued to the Central Trust Company of New York City as Trustee.

Wabash Western.—A dispatch from Richmond, Mo., to the Kansas City *Times* says:

> There is a strong probability that the Wabash will build a line from Lexington Junction through this city and Excelsior Springs to St. Joseph. Its engineers have recently made preliminary surveys over this route, but what report they made of the feasibility of the plan is not known.

Southern Pacific.—Right of way and local aid has been secured for the extension from Victoria to Beeville and it is expected that grading will be put under way soon.

Kansas City, El Paso & Mexican.—A good sized force has begun grading on the first division of this road near El Paso, Tex., under contractor MORRIS R. LOCKE. The citizens of El Paso subscribed $100,000 to the enterprise on condition that the first ten miles of the road should be finished by Oct. 26, Difficulty in obtaining a right of way through the suburbs of El Paso has made this hardly possible; but many of the subscribers to the subsidy have agreed to extend the time for completion to Dec. 1, in view of the right of way trouble.

Atchison, Topeka & Santa Fé.—The earnings of the company for July are not likely to spread much happiness. There was an increase in the length of the road of 412 miles as compared with the mileage of July, 1887, while net earnings fell off $204,135. For the seven months ending with July (mileage increase 533 miles) net earnings decreased $2,404,337, about 50 per cent.—N. Y. *Times.*

Kansas City & Sabine Pass.—It is announced that the contract for building this road from Kansas City south, a distance of 173 miles, has been let to R. P. McCormick & Co., of Kansas City. Also that the Edgar Thomson Steel Works, of Pittsburg, have the contract for 60 miles of 60-lb. steel rails. WM. ANDERSON, of Kansas City, is General Manager.

New Projects and Surveys.

New Orleans, Natchez & Ft. Scott.—A surveying party under C. W. BABBITT, began the preliminary survey of the division from Natchez, Miss., to the county line on Sept. 3. After completing the work on the eastern bank, they will cross over and survey from Vidalia, La., toward the point in Arkansas to which the line has already been located. Among the members of the party are D. F. STACY, C. W. GRAFTON and F. T. FOOTE.

St. Louis & Northwestern.—A preliminary survey has been made of the division from Kirksville, Mo., southeast to Hannibal, and the engineers are now working from Kirksville toward Omaha.

Lake Providence.—The East Carroll Improvement Association, of Lake Providence, La., expects to build a narrow gauge railroad to Macon Hills, about 50 miles, and wishes to purchase second hand equipment.

Kansas City, Arkansas & New Orleans.—Proposals are to be received until Sept. 20 for building this road from Beebe, Ark., to Monroe, La., about 200 miles, with a branch 53 miles in length to Pine Bluff, Ark. Local aid has been secured to the amount of about $800,000, and a mortgage has been issued to the Farmers' Loan & Trust Co., of New York City, for $4,200,000. GEO. M. BARBOUR, President of the company, is receiving bids at Room 418 Rookery Building, Chicago, where specifications and drawings can be seen.

ROCKY MOUNTAIN & PACIFIC.

Existing Roads.

Chicago, Rock Island & Pacific.—Tracklaying is making rapid progress toward Colorado Springs and it is expected to reach there by Oct. 15.——The contract for grading a two mile branch to coal mines, leaving the main line 8 miles east of Colorado Springs, has been awarded to Carlisle, Price & McGavock and J. B. Callahan & Co.

Union Pacific.—A line about 11 miles in length is to be built at once from Fairplay, Col., to the Horseshoe mines. ——Several surveying parties are reported at work in Southern Oregon.

Monterey & Gulf.—The contract for grading the first 40 miles of this Mexican line, from Monterey south has been let to Sullivan Bros. The line will be standard gauge and is projected to extend to Tampico.

Southern Pacific.—The Stockton & Tulare road is completed, with the exception of 4 miles of tracklaying from the junction at Paso, north.——The double track from Oakland to Port Costa is finished.——Great damage has been done by forest fires along the line of the Central Pacific. Over a quarter of a mile of snow sheds have been destroyed, and several station buildings.

Denver & Rio Grande.—According to an interview with President MOFFAT, publised in the Denver *Republican*, the only new lines at present in contemplation are the Lake City and Saguache branches, and about 25 miles down the Grand river,

Northern Pacific.—It is now definitely stated that the company has purchased the entire property of the Cœur d' Alene Ry. & Navigation Co., including the steamers on the lake and 28 miles of narrow gauge railway.—— President ROBERT HARRIS has resigned the Presidency, but will be Chairman of the Board of Directors, while Mr. THOS. F. OAKES has been settled upon by the Directors as the man best fitted to succeed Mr. HARRIS at the head of the company.

San Francisco & Northern Pacific.—The report that President JAS. M. DONAHUE has secured right of way and capital for building an extension from the terminus of the Marin & Napa division at Sear's Point, Cal., easterly across the Sacramento valley to Beckworth Pass, to connect with the Chicago & Northwestern (?) is denied in toto by the principal officers of the company. The $3,000,000 loan recently floated is in bonds on the Cloverdale & Ukiah extension, now nearly ready for the rails. The line is about 28 miles long and has five tunnels, one 4,000 ft. in length. It is one of the most costly pieces of railway work in California.

St. Paul, Minneapolis & Manitoba.—Latest reports from the Wickes tunnel on the Montana Central state that it will probably be "holed" by Sept. 15, and that trains would be running through it by Oct. 1.——Graders have already began work on the Belt Mountain branch near Great Falls, Montana, and it is hoped to have 50 miles in operation by the close of the season. The Belt Mountain mining district, which is given an outlet by the construction of this line, is having a rapid growth since the prospect of cheap transportation became known.

New Projects and Surveys.

Marysville, Sutter City & Colusa.—Incorporated in California to build a railway from Marysville *via* Sutter City to Colusa, about 30 miles. ALEXANDER BUDLAM and WM. C. LYNDE of San Francisco, and W. H. THOMPSON of Oakland are interested. It is expected to have the 10 miles between Marysville and Sutter City in operation by January next.

Ventura & Ojai Valley.—Incorporated in California to build a railway from Ventura to Nordhoff, by E. L. BUCK and J. W. GARDNER, of Santa Ana, J. H. WILEY of San Francisco, and JAS. HUNTINGTON of Nordhoff.

Mason County Central.—Surveys are reported in progress on this line from Shelton, W. T. to Grass Harbor. N. H. OWING of Olympia, W. T, is interested.

CITY OF MEXICO, Sept. 5.—Some months since the Government granted parties here a concession for a railway from Port Tonala on the Pacific coast, State of Chiapas, to such point on the River Grejalva as would permit navigation down to the Gulf of Mexico, with a terminus at Port Frontera. This concession was taken in hand by WILLIAM PRITCHARD of this city, and through him has been transferred to a New York and London syndicate, headed by JOSEPH POOL of New York. The concession is regarded here as a valuable one, and the railway will from the day it is built, get an immense coffee traffic from Guatemala and a large local traffic in tropical produce. It will afford a new interoceanic route through a much healthier region than Panama, and give a new route to Peru and Chili.—N. Y. *Times.*

Proposals Open.

Asphalt Paving.—Paving with cobblestones with top asphalt dressing. Specifications on file. Bids per square yard, surface measurement. SAMUEL M. GRAY, City Engineer, Providence, R. I. September 17.

Bridge.—Iron or wooden bridge across Conestoga creek. Instead of new masonry, bids will be received for repairing the existing work, Proposals for superstructure and repairs to masonry will be received separately or combined. THE BOARD OF COUNTY COMMISSIONERS, Lancaster, Pa. September 17.

Bridge.—Grant St. bridge; grading, masonry and iron superstructure. Plans and specifications at the office of the city engineer. M. MAHONEY, Commissioner of Public Works, Atlanta, Ga. September 17.

Armory.—State armory at Hoosick Falls, N. Y. Architect, I. G. PERRY, Capitol Building, Albany, N. Y. THE ARMORY COMMISSIONERS, State Arsenal, 7th Ave. and 35th st., New York City. September 17.

Street Work.—Granite or brick paving. WILLIAM STEYH, City Engineer, Burlington, Ia. September 17.

Railway—Grading and masonry for a line between Martinsburg W. Va., and Winchester, Va., 23½ miles. Maps profiles and specifications at the engineer's office. CHAUNCEY IVES, Chief Engineer, Cumberland Valley & Martinsburg R. R., Chambersburg, Pa. September 18.

Sewers.—Brick sewers; 565 ft. of 64-in., 1,435 ft. of 56-in., 200 ft. of 24-in.; pipe sewers, 460 ft. and 150 ft. of 12-in. Bricks, pipes, cement, iron, flagstone and granite furnished by the city. SAMUEL M. GRAY, City Engineer, Providence, R. I. September 19.

Lighthouse.—On Gould island. Amount available, $7,300. Major D. P. HEAP, U. S. Lighthouse Engineer, Tompkinsville, N. Y. September 20.

Sewers.—JOHN P. ADAMS, Commissioner of City Works, Municipal Building, Brooklyn, N. Y. September 24.

Lamp Posts.—Setting gas lamp posts. JOHN P. ADAMS, Commissioner of City Works, Municipal Building, Brooklyn, N. Y. September 24.

City Work.—Brick paving, stone curbing, sewers, inlets; 8-in., 12-in. and 18-in. vitrified pipe sewers. Samples of paving brick to be submitted. GEORGE MCINTOSH, Chairman, General Improvement Committee, Bloomington, Ill. September 25.

Court House.—Erection and completion of a new court house at Calhoun, Gordon Co., Ga. Architect, W. H. PARKINS, of Atlanta. THE COUNTY COMMISSIONERS, Calhoun, Ga., October 1.

Water-Works.—Complete system, with stand-pipe, on franchise plan. The successful bidder will be required to furnish a bond of $1,000, with the condition that he will expend at least $5,000 in labor and material within 3 months after the contract is awarded, and that the works will be completed and in successful operation before September 1, 1889. W. H. BEHRENS, City Clerk, Carlinville, Ill. October 1.

Bridge.—Superstructure of bridge across the Gowanus canal at Carroll St. JOHN P. ADAMS, Commissioner of City Works, Municipal Building, Brooklyn, N. Y. October 1.

Mineral Oil.—About 125,000 galls. of mineral oil. Preference given to articles of domestic production and manufacture, conditions of price and quality being equal, and such preference given to articles of American production and manufacture produced on the Pacific coast, to the extent of the consumption required by the public service there. HENRY C. HODGES, Dep. Q. M. Gen., U. S. A., Jeffersonville, Ind., October 2.

Bridge.—Across Camp creek. Plans and specifications on file. JOHN T. COOPER, Clerk, Commissioners of Roads and Revenues of Fulton Co., Atlanta, Ga. October 3.

Sewerage.—Extension of the present sewerage system. Plans and specifications in the office of the City Engineer. THE COMMITTEE ON SANITATION, Montgomery, Ala. October 15.

Contracting.

Bridges.—The Milwaukee Bridge & Iron Co., of Milwaukee, Wis., has been awarded contracts for three bridges in the city of Watertown, Dak. Contract prices, $26,000.

Pumping Engine.—The Board of Public Works, Jersey City, N. J., has awarded the contract for the new pumping engine at the high service station to H. R. Worthington, of New York, at $30,500.

Electric Light Plant.—Electric light plants for the arc and incandescent systems are to be established at Aberdeen, Miss., and manufacturers are invited to correspond with Messrs. Paine and Dalton, of that city.—— H. B. Peters, of Greensboro, N. C., also wishes correspondence with manufacturers of electric light plant.

Tunnel.—The contract for building a tunnel 1,320 ft. long, through Pisgah mountain, in Haywood Co., Tennessee, for the Carolina, Knoxville & Western R. R., has been awarded to Z. T. Copeland, of Birmingham, Ala., who will commence work shortly.

Valves.—At Washington, D. C., the contracts for water valves have been awarded by the Commissioners to H. McShane & Co. and Somerville & Son.

Dry-Dock.—The contract for dredging for Dunford & Alverson's new dry-dock, at Port Huron, Mich., has been awarded to Hickler & Green, of Buffalo, N. Y., at $6,000. Work will be commenced at once. The dock will be of the following dimensions: 400 ft. long, 80 ft. wide at top, 30 ft. wide at bottom, 17 ft. depth of water.

Pipe Laying.—*Amsterdam, N. Y.*—A contract for laying water mains has been awarded to James Doran and John E. Lanahan at 17 cts. per lin. ft.

Malden, Mass.—The contract for laying water pipe from the wells at Eatons meadows to the stand-pipe at Wiatts hill, has been awarded to J. J. Newman, of Providence R. I.

Jersey City, N. J.—The contract for laying 800 ft. of 24-in. iron sewer pipe has been awarded to P. J. Condon at $1.38 per lin. ft., and $1 per cu. yd. for rock excavation.

Bloomington, Ill.—The contract for laying water mains for the coming year has been awarded to Robt. Loudon, at 16 and 20 cts. per ft. for 4 and 6-in. pipe.

Railroad Buildings.—*Portland, Me.*—The Maine Central R. R. Co. will build a freight house 300 ft. by 30 ft.

Lynchburg, Va.—The contract for the new brick depot for the Norfolk & Western R. R. has been awarded to Adams & Woodson, for $30,000. Work is to be finished by January,

Wheeling, W. Va.—The Baltimore & Ohio R. R. Co. will erect a 32-stall roundhouse, machine shops not less than 120 ft. square, and also car, repair, blacksmith, paint and other shops.

Selma, Ala.—A union depot, 300 ft. by 65 ft. in plan, will be built by the East Tennessee, Virginia & Georgia R. R. and other roads, at a cost of $25,000.

Romeo, Mich.—The Grand Trunk Ry. Co. will build a new depot. Plans and specifications have been prepared.

The Rome Contracting & Building Co. has been incorporated at Rome, Ga., with a capital stock of $100,000.

Cross-Ties.—The Lynchburg & Durham R. R. Co. is receiving bids for furnishing cross-ties for 6 miles of track.

Chignecto Ship Railway.—The contract for the grading, masonry and dredging of the line and the terminal docks of the Chignecto Ship Railway has been let to Dawson, Symmes & Usher, of Niagara Falls, N. Y., and work will be commenced at once.

Asphalt Paving.—At Philadelphia, Pa., an ordinance has been introduced to appropriate $10,000 for repaving Diamond St., west from 2nd St., with a sheet asphaltum pavement.——At Albany, N. Y., the market site committee, in its report, which has been adopted by the City Council, has recommended that Trinidad asphalt pavement be laid.——At Kansas City, Mo., the street and alley committee has reported in favor of asphalt paving on 15th St.

Drainage.—The State House Commission, Columbia, S. C., has awarded the contract for furnishing complete the drainage and vent-pipe system at the State Capitol to the Durham House Drainage Co., of New York City. The architects of the State House are White & Miernsée, of Columbia.

Sewers.—At Helena, Mont., the mayor, in a letter to the Council on the newly authorized sewer system, work on which is to be commenced at once, recommends that the contracts for the digging of the ditches be let in short sections so that the work may be open to small bidders, and that every precaution be taken to make it certain that the money shall be expended among the people of Helena, and that the contracts shall not be let to anyone who will seek to import laborers to perform the work.

Street Work.—*Brooklyn, N. Y.*—The following are the prices of proposals received by Commissioner of City Works ADAMS: Flagging sidewalks, 22½ cts. per sq. ft.; fencing lots, 57½ cts. per lin. ft.; grading and paving, $2.99½ to $3.99 per lin. ft.

Oshkosh, Wis.—A paving contract has been let to John Martin at $1.05½ per sq. yd. for paving, and 35 cts. per lin. ft. for curbing. A former bid for $1.33 and 47 cts. respectively, made by Wm. Sharpe, had been rejected.

Troy, N. Y.—The Contract Board has awarded the contract for paving Washington St. to Malone & McKenna, at $2.97 per sq. yd. for paving and 83 cts. per lin. ft. for curbing. A contract for 300 cu. yds. of gravel was let to E. C. Weld at 35 cts. per cu. yd.

Bridge.—The following proposals have been received by JOHN H. LEE, County Clerk, Keytesville, Mo., for an iron bridge, including piling, substructure, etc.: Milwaukee Bridge & Iron Co., Milwaukee, Wis., $3,000; Bullen Bridge Co. Kansas City, Mo., $3,110; Missouri Valley Bridge Co., Leavenworth, Kan., $3,250; J. W. Hoover, Kansas City, Mo., $3,250; St. Louis Bridge & Iron Co., St. Louis, Mo., $3,280; Geo. E. King & Co., Des Moines, Ia., $3,325; Kansas City Bridge & Iron Co., Kansas City, Mo., $3,500. The contract was awarded to the Milwaukee Bridge & Iron Co. The structure is to be a combination Howe truss bridge, one span of 130 ft., across the Chariton river.

Water-Works.—*Baker City, Ore.*—The following proposals have been received, the first being for cast-iron pipe, and the others for wooden pipe: P. Basche & Co., $45,000; M. P. White, $44,111.63; Puget Sound Pipe Co. (JOHN CORLISH, President), $34,000 and $26,500. The distance from which water is to be supplied is 7¾ miles, and there are to be reservoirs.

Bridge.—The Canada Atlantic Railway Co. has awarded the contract for the construction of a bridge across the St. Lawrence river between Coteau Landing and Valleyfield, to Messrs. James A. McMahon, George A. Begy and Wm. M. Shea, contractors, of St. Catherines, Ont., who will commence work at once. The contract price is $560,000. The bridge will be 2 miles long and will be carried on 16 piers and 6 abutments.

Macadam.—At St. Louis, Mo., J. G. JOYCE & SONS, engineers for the Harlem Heights Land & Improvement Co., have awarded a contract for street work at 13½ cts. per cu. yd. for grading, and $4.94½ per sq. of 100 cu. ft. for macadam. Average haul of earth, 350 ft. The macadam to be quarried, delivered and spread.

Outlet Sewer.—The following proposals for the construction of a main outlet sewer, 4,100 ft. long, have been received by THOS. BODLEY, City Clerk, San Jose, Cal.: Wehner & Fenell, San Jose, $2,988; Thos. Treanor, San Jose, $4,000; Peter Rosenbaum, San Jose, $4,796; Harry King, San Jose, $4,999.51; San Jose Improvement Co., San Jose, $5,660; H. Kruse, San Francisco, $5,987; C. D. Vincent, San Jose, $6,000; Thos. Doyle, San Jose, $6,437; H. J. McGee & Co., San Jose, $7,000; E. Basse, San Jose, $7,100. The contract was awarded to Wehner & Fenell, at $2,988.

Brooklyn Federal Building.—The lowest bidder for the construction of the superstructure of the post-office building, etc., at Brooklyn, N. Y., has failed to execute the bonds and has forfeited the contract. His bid was $623,000. The contract has been awarded to the next lowest bidder, Bernard Gallagher, of Brooklyn, at $860,000. Mr. Gallagher has put up many public buildings, including the armories for the 14th, 23rd and 32nd regiments; also the Fulton and Washington markets in New York.

Culverts.—*Albany, N. Y.*—Superintendent of Public Works SHANAHAN has received bids for building a culvert over Mill creek, Schenectady, and making an open cut from it to the Mohawk river. There were but two proposals. The legislature appropriated $10,000, and as the work cannot be done for that amount under the bids received the contract was not awarded. The bids were: Andrew Kinam, Schenectady, $9,978.50; Van Vranken & Clements, Schenectady, $10,597.50. —— Mr. Shanahan has awarded the contracts for building culverts over the State ditch at Goundry and Morgan Sts., Tonowanda, to Peterson & Whitmore, of Lockport, for $4,407.42 and $3,593.

Pipe.—The following proposals for about 400 tons of 18-in. cast-iron water pipe, weighing 134 lbs. per foot, have been received by A. V. POWELL, Superintendent of Public Works, Hyde Park, Ill.: Lake Shore Foundry, Cleveland, O., $27.35 per ton, $10,940; Addyston Pipe & Steel Co., Cincinnati, O. (A. A. Bogue), $27.49, $10,996; R. D. Wood & Co., Philadelphia, Pa., $27.95, $11,180; Shickle, Harrison & Howard Iron Co., St. Louis, Mo., $28.50, $11,400; Dennis Long & Co., Louisville, Ky., $28.90 $11,560; McNeal Pipe & Foundry Co., Burlington, N. J., $34.35, $13,740. The contract was awarded to the Lake Shore Foundry Co.; deliveries to be made this month.

Tube Wells.—The Cook Tube Well Co., of St. Louis, Mo., has issued an illustrated catalogue, descriptive of its special plant, which is patented. There are particulars and prices of pumps, strainers, barrels, valves, tools, pipe, etc. Also testimonials from the Artesian Water Co., of Memphis, Tenn., and others. There is a list of 39 references, 12 of these being water-works. The company undertakes the business of contractors and hydraulic engineers, and operates the patents of Cook's system of tube wells for water-works for cities, railroads, manufactories, etc. President, H. F. COOK; Vice President, A. F. COOK; Secretary, N. E. COOK.

The Tudor Iron Works, St. Louis, Mo., has issued a well got up pamphlet of its specialties of manufacture. It is well printed on good paper and contains neat engravings of standard rail joints of different railways; also engravings and particulars of spikes, track and other bolts, nuts, switches and frogs. There are light T rail sections, from 8 to 24 lbs. per yard, and street rail sections, with information as to the joints, spikes, etc., per mile of track. There are tables of weights of square, round and flat iron. Nine pages are devoted to the explanation of the company's cipher of quantities, prices, etc. T. A. MEYSENBURG, President; B. S. ADAMS, Secretary; F. W. OLIVER, Treasurer.

New Depot at St. Louis.—It is reported that Mr. GOULD has ordered the construction of the new union depot at St. Louis, Mo., which was projected two years ago, to be commenced without unnecessary delay. Considerable land has already been acquired, but some of the leases do not expire until March, but it is hoped to begin work before that time. The new building is to be an extensive and handsome structure, and it is thought that the old depot may be used by the Adams Express Co. The roads represented on the Governing Board of the Depot Trustees are the Missouri Pacific, Louisville & Nashville, Ohio & Mississippi, Indianapolis & St. Louis and Terre Haute & Indianapolis.

Bridge Masonry.—The following proposals for rebuilding one and topping out the other abutment of bridge over Turtle creek at Moss Side, and one abutment of bridge over Falling-timber run, at Elizabeth, have been received by CHAS. DAVIS, County Engineer, Pittsburg, Pa.: Chas. M. Driver, Allegheny, Pa., $8.85 per cu. yd. for the Moss Side bridge, and $9.35 per cu. yd. for the Elizabeth bridge; Wm. Dickson, Sewickley, Pa., $9.35 per cu. yd. for the Moss Side bridge, and $8.35 per cu. yd. for the Elizabeth bridge; Chas. J. Lundquist, Elizabeth, Pa., $8.95 per cu. yd. for the Elizabeth bridge. The contract for work on the Moss Side bridge was let to Chas. M. Driver, and that for work on the Elizabeth bridge to Wm. Dickson. The price is for good stone, per cubic yard, in place, and includes excavation, pumping shoring, coffer-dam, etc.

City Work.—*Newark, N. J.*—The following contracts have been awarded by ERNEST ADAM, City Surveyor: Providence St.; Thomas O'Connor, 25 cts. per cu. yd. for excavation, 40 cts. per lin. ft. for curbing.—— Boyd St.; Thomas O'Connor, 28 cts. and 40 cts. for excavation and curbing.——Dickerson St.; Hughes & Flynn 15 and 12-in. pipe, $1.35 and $1.25 per lin. ft.; basins, $110; manholes, $10; average cut, 11 ft.——Mott St.; John H. Wilkie, 15-in. pipe, $1.37 per ft.; basins, $100; manholes, $35; average cut, 12 ft.——Plane St.; James Maguire, 12-in. pipe, $1.85 per ft.; manholes, $33; flushing tank, $90; average cut, 11½ ft.——Nesbitt St.; James Maguire, 12-in. pipe, $1.60; basins, $129; manholes, $33; average cut, 10 ft.——Clifton Ave.; Satchwell & Bellingham, 12-in. pipe, $1.90 per ft.; basins, $100; manholes, $35; average cut, 10½ ft.

Excavation.—The Pound Mfg. Co., of Lockport, N. Y., which manufactures dredges, derricks, steam shovels, ore and coal hoisters, ditching machines, steam engines, steam canal boat machinery, etc., has issued a circular describing its system of canal excavation, which system consists of working dredges and derrick together, the dredge digging the material and the derrick carrying the material away from the dredge and depositing it at any desired point on the bank. The dredge empties the stuff, 7 or 8 tons, into a box, which is hoisted and emptied by the derrick while the dredge is digging another load; the derrick runs on a portable track on the bank. The system has been employed on the Welland, Lachine and Cornwall canals, in Canada, and on the Erie and the Illinois and Michigan canals in this country. The company has recently completed a dredge of large capacity, which is offered for sale, and detailed descriptions of any of the plant manufactured will be sent to parties who may desire it.

Lighthouse.—The following proposals have been received by the U. S. Lighthouse Engineer, Portland, Ore., for furnishing the material and labor necessary for the erection of a lighthouse at Cape Meares, Oregon: M. J. S. Carkeek, Seattle, Wash. Ter., $9,450 for the erection of tower, $27,500 for keepers' dwellings, etc.; Phœnix Iron Co., Trenton, N. J., $9,750 for metal work of lighthouse tower, W. E. Wilson and Isaac Nixon, Seattle, Wash. Ter., $24,500 for metal work of tower, $16,000 for erection of tower, $40,725 for keepers' dwellings, etc.; Colwell Iron Works, New York, $8,500 for metal work in tower; Lewis W. Holt and Frank McCurtie, Astoria, Ore., $27,445 for keepers' dwellings, etc.; John Cooper, Mt. Vernon, O., $9,822 for metal work of tower; Calvin Nutting & Son, San Francisco, Cal., $9,300 for metal work of tower; Richard Leaman, Portland, Ore., $12,200 for erection of tower, $26,000 for keepers' dwellings, etc.; Chas. B. Duhrkoop, Portland, Ore., $2,900 for erection of tower, $53,500 for keepers' dwellings, etc.; Willamette Iron Works, Portland, Ore., $7,800 for metal work of tower.

Machine and Boiler Works.—The works of E. Hodge & Co., East Boston, Mass., which were established in 1864, are very busy, the shop being operated to its full capacity and giving employment to 75 or 100 hands. Among recent orders received is one for three 150 H.P. boilers for the West End Railway Co.'s electric system, this being the first order this company has placed for boilers for railroad purposes, which will be put into use upon the Brookline branch. Among other recent orders are one from the Newport Electric Light Co., and one from the Seattle Electric Light Co., of Seattle, Wash. Ter. The company is also doing a large amount of work for water supply companies, and is now constructing a stand-pipe, 20 ft. in diameter, and 120 ft. high for Mansfield, Mass., and has orders for another 20 ft. x 90 ft. to go to Kentucky, and one 100 ft. high to go to Florida to be built the coming winter. Hodge & Co.'s works are fitted with the most modern appliances and tools, and a new hydraulic riveting machine has recently been imported from Europe capable of riveting a plate 8 ft. wide.

Jetty.—The following proposals for repairing a jetty of brush and stone at Sand Island light station, Mobile bay, Alabama, have been received by Capt. W. L. FISK, U. S. Lighthouse Engineer, New Orleans, La.: *First Plan;* Andrew Olsen, Mobile, Ala.; about 1,000 cu. yds. brush

mattress in place, $4.95 per cu. yd.; 1,600 tons of oyster shells in place, $5.89 per ton of 2,240 lbs.; 1,000 tons of ballast rock, $5.47 per ton of 2,240 lbs.; 500 cu. yds. large stones transported and placed in work, $16.44 per cu. yd.; total, $28,064. S. S. Leonard, Pensacola, Fla.; brush mattress, $2.15: oyster shells, $4.75; ballast rock, $3.20; large stones, $3.05; total, $14,475. John H. Gardner, New Orleans, La.; brush mattress, $3.50; oyster shells, $2.25; ballast rock, $3; large stones, $1; total, $15,600. F. A. Brock, Galveston, Tex.; brush mattress, $1.50; oyster shells, $1.35; ballast rock, $3.10; large stone, $2; total, $7,760.——*Second Plan*; Andrew Olsen; 2,200 tons of oyster shells in place, $5.95 per ton; 1,300 tons of ballast rock, $5.47 per ton of 2,240 lbs.; 500 cu. yds. of large stone in work, $16.44 per cu yd.; total, $28,421. S. S. Leonard; oyster shells, $4.75; ballast rock, $3.25; large stone, $3.05; total, $16,135. John H. Gardner; oyster shells, $2; ballast rock, $3; large stone, $11; total, $13,800; F. A. Brock, oyster shells, $1.35; ballast rock, $3.10; large stone, $2; total, $8,000.

Viaduct.—At Chicago, Ill., the Commissioner of Public Works has awarded the contract for the construction of the superstructure of the Twelfth St. viaduct extension from Clark St. to State St., to Riter & Conley, of Pittsburg, Pa., at $109,348. The next lowest bid was from the Detroit Bridge & Iron Works, $112,020. The structure will be an extension of the viaduct approach to 12th St., and will be 58 ft. 3 ins. wide, having two roadways. As it will extend over the tracks of the Western Indiana and the Santa Fé roads, those corporations will have to pay the entire cost of the superstructure, also of the substructure—some $18,000. It is intended that the viaduct shall not stop at State St. The intention is, and the agreement with the Atchison, Topeka & Santa Fé road means, that the viaduct is to be extended across State St. to approaches north and south on Victoria alley between Wabash Ave. and State St., the alley to be widened to the width of 50 ft., and the grade of the approaches to be 1 in 70. The section now to be contracted for will be completed April 1, 1889. Passenger approaches to the viaduct will be constructed on the west line of State St. The whole work will not cost the taxpayers a dollar. The railroads will have to pay, not only for the viaduct and approaches but for damages also.——Another viaduct is proposed over the railway tracks on West Madison St. at its intersection with Rockwell St., as suggested by President YERKES of the West Side cable road.

The Holyoke Bridge.—The following are the proposals received by the Bridge Commissioners at Holyoke, Mass.: Rochester Bridge Co., A, pin connection, $112,830; B, truss, $113,370. King Iron Bridge & Mfg. Co., Cleveland, O., A, $137,969; B, $142,746. Keystone Bridge Co., A, $117,000; B, $131,300. Corcoran & Taylor, of Pennsylvania, A, $122,200. Variety Iron Works, A, $163,000, Union Bridge Co., New York, A, 135,980; B, $142,125. Passaic Rolling Mill Co., Passaic, N. J., A, $125,000; B, $133,500. Berlin Bridge Co., A, $150,000: B, $153,000; an original plan, $146,200. New Jersey Steel & Iron Works, A, $137,274; B, $150,000. Nelson & Buchanan, Pittsburg, A, $142,600; B, $141,000. Penn Bridge Co., Beaver Falls, Pa., A, $135,000; B, $137,000. Hilton Bridge Co., Albany, N. Y., A, $124,900. Wrought-Iron Bridge Co., Canton, O., A, $110,500. Boston Bridge Co., A, $159,950; B, $158,200. Edge Moor Iron Co., Wilmington, Del., A. $114,500; B, $126,000. Mt. Vernon Bridge Co., A, $131,500. R. F. Hawkins, Springfield, A, $126,000; B, $125,000. Columbia Bridge Co., Dayton, O., A, $137,000.

The following is from the Springfield *Republican*: "The Hampden and Hampshire county commissioners met at Holyoke to open the bids for the new bridge over the river, between that city and South Hadley Falls, but while there were bids enough, companies from all over the country having sent in proposals, yet the figures were so in excess of the appropriation that no award was made. The Legislature granted the commissioners $100,000 for the new structure, and the engineer drew his plans with this amount in view, and with the idea of using the same piers and having the new bridge the same width as the old. At the hearing, however, it was found that no one wished this kind of a structure, but would be only satisfied with the best. So all the bids that have been received have been made with a first class structure in view. The commissioners, however, having taken legal counsel, find that they have no authority to go over the appropriation of $100,000 and an appeal to the Legislature to increase this amount by $50,000 will probably be made before the contract is awarded."

WATER.

Albina, Ore.—The new tank of the Albina Water Co., which was completed recently and cost $3,500, gave way August 25, owing, it is said to the timbers of the support not being braced, so that the movement of the water caused the structure to sway. The tank had a capacity of 150,000 galls.

Meters.—C. S. BROWN, who has for the past four years represented the National Meter Co., selling meters in the West, has been engaged by the Hersey Meter Co. to sell the Hersey meter in the same territory.

Water-Works.—*New Hampshire.*—Portsmouth. A reservoir is to be located at the west end for the use of the fire department.——Groveton. Water-works are to be established.

Massachusetts.—Northampton. Pumps have been running in the new well of Belding's and show a flow in the well of 60 galls. a minute, without apparently diminishing the supply. The works are using about 70 galls. a minute and the well may reach that point when cleared out.——Needham. Water-works are projected.

Rhode Island.—Providence. The Board of Public Works has petitioned for an appropriation of $50,000 for the Fruit Hill reservoir. The matter has been referred to the Finance Committee.

Connecticut.—Mystic. The Mystic Valley Water Co. has issued its stock. About 150 men are laying pipe in Mystic Bridge.

New York.—Albany. The test of the new water supply will not be commenced until October.——Troy. A water famine is feared on account of the pump of the city water-works being inadequate for the demand.——Poughkeepsie. During August the pumpage amounted to 50,693,328 galls.; 15 additional meters were set.——Cattaraugus. A serious fire occurred recently and the water supply and the fire apparatus of the village were found to be totally inadequate. A meeting was held some time ago at which it was proposed to bond the village for the purpose of getting a water supply, but the proposition was voted down and the place was left unprotected. The same district was burned in 1880.

New Jersey.—Bloomfield. The East Orange Water Co's side of the water question has been presented to the Bloomfield Town Committee. President SHEPARD and Superintendent OLCOTT represented thecompany, and denied that water had been supplied to factories to the detriment of Bloomfield. No water had been supplied to factories. It was also promised that the full pressure would hereafter be maintained, but that next year there should be a restriction as to sprinkling lawns and gardens.

Pennsylvania.—Oil City. The pump house of the city works was destroyed by fire Sept. 3, and the machinery badly damaged.——Allegheny. An ordinance has been passed authorizing the issue of $50,000 water bonds for paying for new pumping engines.— Meyersdale. The Meyersdale Water Co. has voted to increase its capital stock to $16,000. Work is progressing slowly.——Reading. The City Councils have defeated the ordinance to increase the city water supply by establishing a pumping station on the Maiden creek. The question of a city loan for the same purpose was defeated by a popular vote last spring.——New Haven. The water main across the bed of the river was washed away by the recent flood. A small pipe has been laid across the suspension bridge for temporary purposes.

Ohio.—Cleveland. The Water-Works Trustees will expend about $150,000 in pipe extensions this year. It is expected that the department will realize 8 per cent. per annum on the outlay from the new water tenants. There will be nearly 300 miles of main and distributing water pipe in the streets of the city at the close of the year.

Virginia.—South Boston. Water-works are to be built. Proposals will be opened to-day by W. D. BARBOUR.

Tennessee.—Nashville. A bill is before the City Council providing for an appropriation of $73,996 to purchase pipe for a connection with the new water-works.

Georgia.—Marietta. The Marietta & North Georgia Real Estate & Improvement Co. proposes to build water-works.

Alabama.—Mobile. The Bienville Water Supply Co. has completed its 12,000,000 galls. reservoir and commenced pipe laying for the new water plugs.

Indiana.—Jeffersonville. The stand-pipe of the new water-works has reached a height of 120 ft. The pumping machinery has been delivered.

Michigan.—Lansing. The amount of water pumping during August was 36,573,425 galls.——Kalamazoo. The average daily amount of water pumped during August was 1,915,020 galls.——Detroit. A considerable amount of new pipe is to be laid. Superintendent Bridge has prepared plans for a new inlet pipe, to be used should emergency require it, when the present inlet pipes are choked by anchor ice. The plans were approved and the superintendent has been instructed to have the work done.

Illinois.—Peoria. The Water-Works Committee will lay 1,050 ft. of 4-in. pipe, 750 ft. of 6-in. and 325 ft. of 12-in., at a cost of about $1,300.——Carlinville. A stand-pipe system of water-works is to be established; proposals will be opened Oct. 1.——Cairo. The water company will put in a filter as soon as the river has gone down.

Minnesota.—Winona. No further extension of the water mains can be made this year, as the expense of sinking the new well will exhaust all the funds.

Missouri.—Washington. The water-works company has completed laying 2½ miles of the water mains, and expects to finish its contract of 4½ miles by Oct. 8.

Kansas.—Kansas City. The Council has passed the water ordinance, providing for laying water mains on a number of streets, the present water service being insufficient. New hydrants will be located on the pipe line.

California.—Petaluma. A serious fire occurred recently and could not be controlled for some time as the water company had shut off water, owing to the supply in the reservoir being low.——San Bernardino. Propositions for establishing a water supply are being received. Bonds will be issued.——Haywards. The water-works are about completed; the reservoir is 98 ft. by 52 ft. and 15 ft. deep; it is lined with cement. It is at an elevation of 160 ft. above the town.——Sonoma. New water works are being constructed for this place by DR. L. B. LAWRENCE, who has an artesian well in the suburbs that flows 280,000 galls. per day.

Washington Territory.—Walla Walla. At the Council Meeting on Sept. 5, the committee on fire and water reported that the recent official test of the water supply had shown that the supply is deficient for fire purposes whereupon the council voted to stop the pay of the water company for such service. The city something over a year ago entered into a contract with the water company whereby the city was to be supplied with water for fire and domestic purposes, for which the city was to pay $1,500 per year. The water company has been given ninety days in which to comply with the contract.

Jersey City, N. J.—On Sept. 6, the Board of Public Works held a public meeting for the discussion of the water supply question, and gave a hearing to parties interested in the matter. The meeting finally adopted the following resolution: *Resolved*, That it is the sense of this meeting that Jersey City shall, under any and all circumstances, own and control her water supply, and that we consider it against public policy to enter into any contract with a private corporation for the purchase of a supply of water; and, further, we believe it to be unnecessary to provide a new water supply.——With regard to the charges against the Water Department, the Board of Public Works has ordered an investigation.

Steam Heating.—The Syracuse Heat & Power Co. has applied for a franchise at Syracuse, N. Y. The company proposes to lay mains for furnishing a supply of steam hot water and hot air; it must obtain the consent of property owners and must repair the streets after laying the pipes. Sewers, water pipes or gas mains are not to be disturbed. Steam heat and power must be furnished when demanded, to all public buildings along its mains and to the fire department at a price 75 per cent. of the most favorable price to private consumers, but the city is not required to be a customer. The capital stock is $150,000, all of which must be subscribed for, and 25 per cent. paid in before work is commenced.

Passaic, N. J.—The Passaic City Common Council recently passed an ordinance providing for the emptying of all the sewage of the city into the Passaic river, and the Mayor approved it. When the ordinance goes into effect the sewage of Passaic City will pour directly into the receiving basin of the Jersey City and Newark water-works. The Newark Aqueduct Board, at its last meeting, instructed its counsel to begin proceedings by injunction against Passaic City to prevent the enforcing of the ordinance. Inspector Leake and the counsel of the Board of Works made out a formal report of the matter for presentation to the Jersey City Board of Works, and the Board will order counsel to get an injunction to prevent Passaic City from enforcing the ordinance. The action will be separate from the proceedings of the Newark authorities, and each city will bear the expenses of its own case.—Paterson *Guardian*.

Memphis Water Supply.—One of the most interesting problems in water-works construction in the country is being solved at Memphis, Tenn.; and the new scheme contemplates an entire change in the supply and a radical reconstruction of the existing works, made necessary by the almost phenomenal growth of that city, in population and wealth, in the last ten years. Heretofore the Mississippi river had been solely depended upon for all uses; but it has been lately discovered that another mighty river flows underneath the city and that it can be brought to the surface by artesian wells. Temporary works now in operation supply a part of the city with 5,000,000 galls. daily of clear water from this source. The general system now under contract is to furnish 30,000,000 galls. in 24 hours. The wells are 6 ins. in diameter, sunk 50 ft. apart, and the pressure is just sufficient to bring the water to the surface. It is consequently expedient to tap this water stratum as low as possible, and the proposed plant includes vertical pumping engines with the water-end located in a pump-well about 50 ft. below the surface, the wells being tapped at this level and the connecting mains laid in tunnels. This pumping plant includes three 10,000,000-gall. engines of the Worthington compound condensing high-duty type, with space provided for a fourth engine. The same company also provides the entire boiler plant, and the outfit will be one of the largest new pumping plants yet constructed in this country, and it is thought to be the most complete in its appointments. The saving in fuel alone is estimated at one-half on the consumption of the old engines, and the engines selected certainly have the longest record for reliability and efficiency, and a guaranteed highest economic duty. Mr. THOS. J. WHITMAN, of St. Louis, is the Chief Engineer, and Mr. THOS. J. JOHNSON, formerly of Chicago, is the Resident Engineer. The present water company is a wise combination and consolidation of old and new companies.

Gas Pipe Line.—The Kentucky Rock Gas Co., of Louisville, Ky., will issue bonds for $500,000 for the construction of the pipe line from the wells near Brandenburg to Louisville. Work will be commenced soon.

Brooklyn, N. Y.—It is reported that the Department of City Works will again recommend to the Common Council the plans for relief sewers prepared in 1885 by City Engineer VAN BUREN. At that time the then Commissioner of City Works had Mr. VAN BUREN and other engineers prepare comprehensive plans for the relief of the flooded districts and send them to the Council. These plans did not suit the Aldermen, who authorized work of a smaller, and, as it turned out, not altogether effective character. The larger plans provided for an expenditure of $958,000 of which $875,000 was for a big intercepting sewer on Greene Ave. Had this work been done the city might have avoided litigation which has cost it several thousand dollars. The intercepting sewer proposed for Greene Ave. was to run from Marcy Ave. down to Hanson Place, Fourth Ave., Dean and Amity Sts., to the river, the diameter being 11 ft. at Marcy Ave. and 15 ft. at the outlet. This would relieve the flooded district near Flushing Ave.

Wilmington, N. C.—The special committee appointed to investigate the complaints against the Clarendon Water-Works Co. for non-performance of the conditions of the contract with the city, has reported, after careful investigation and the examination of witnesses, that the company has failed to comply with the conditions as to the height of fire streams and the quantity of supply. The committee is of opinion that the failure is principally due to the small size of the mains. The committee also find that the water furnished is not suitable in many respects for domestic use, and particularly for drinking purposes and washing clothes. For the non-performance of the contract by the company in these particulars the committee are of the opinion that the contract has been forfeited and should be annulled, but appreciating the value and importance of the water-works to the city and the citizens generally, and desiring if possible to remedy the existing objections without injury to an important and valuable enterprise, the committee recommend that the company be notified that the city will require improvements to be made so as to comply with the terms of said contract, and if the same are not made witnin 90 days from this date, the city will proceed to annul the same. The report was received and adopted at a meeting of the Board of Aldermen on Sept. 3.

The Crown Meter.—The National Meter Co., of New York, has issued its autumn circular, which shows that from 1879 to Sept. 1, 1888, 59,000 water meters have been manufactured by the company; of this number 54,417 were "Crown" meters, and the balance "Empire" and "Gem" meters. One page is devoted to extracts from a paper by CHAS. B. BRUSH, C. E., of Hoboken, N. J., (this paper has been published in our columns), and another page to extracts from a paper by E. B. WESTON, C. E., of Providence, R. I., relating to the meter system of that city. The following tables are given, from the report of the Water Meter Testing Commission, Boston, Mass, 1888.

FIRST ACCURACY TEST.

Error of Meter.

Extremes.				
Min. per cent.	Max. per cent.	Average per cent.	Range per cent.	Number of Experiments.
—.2	+2.2	+1.3	2.4	36

SECOND ACCURACY TEST.
(After Registering 78,000 Cubic Feet.)

Error of Meter.

Extremes.				
Min. per cent.	Max. per cent.	Average per cent.	Range per cent.	Number of Experiments.
—.8	—3.6	—2.	2.8	8

This relates to a ¾-in. Crown meter, No. 45,073, and 78,000 cu. ft. of water passed through it in 12 days. The following is quoted from the report: "The Testing Commission believes that this meter (Crown) may be used with general satisfaction."

Allegheny, Pa.—There is considerable trouble over the electric lighting scheme, all attempts at securing a favorable contract for the city having failed. The suggestion has been made that the city should establish and operate a plant, instead of contracting with a company. A local paper says: "If a city may profitably manage an artificial gas works, it can much more safely run an electric light plant. Now that all bids for supplying the city with electric light have been withdrawn, it might be well for the Gas Committee to inquire into the feasibility of procuring a plant at the expense of the city."

Electric Lighting.—***Laconia, N. H.*** The arc system of electric lighting was put in operation Sept. 1 and is giving satisfaction. The system is being extended.

Pawtucket, R. I.—After about 5 months delay the ordinance in relation to the city establishing an electric light plant of its own has been passed. The joint standing committee on street lights is authorized to contract for an entire plant, engines, boilers, dynamos, wire, lamps, etc.

Mystic, Conn.—The electric light is to be introduced, and 400 lights have already been contracted for.

Plantsville, Conn.—The electric light company is erecting its poles on the streets.

Norwich, N. Y.—The Norwich Electric Light & Power Co., capital stock $25,000, has been incorporated by DUDLEY FARLIN, S. B. GARDNER, ELMER BLAIR, G. W. RAY and GEO. W. BROOKS.

Albany, N. Y.—The Edison Electric Light & Power Co. has increased its capital stock to $60,000 and will increase its plant.

Syracuse, N. Y.—The Sweet Mfg. Co. has applied for an electric light franchise.

Allegheny, Pa.—All the electric light bids have been rejected and new bids will be advertised for.

Bristol, Pa.—The Council has decided to adopt a system of electric lights for the borough.

Greenville, Tenn.—An electric light system will probably be established.

Greensboro, N. C.—The Greensboro Gas & Electric Light Co. will put in an electric light plant.

Jackson, Miss.—On Sept. 5, the city made a contract with the Jenney Electric Light Co., of Indianapolis, Ind., for electric lights.

Aberdeen, Miss.—The City Council proposes to have arc and incandescent electric lights established. Messrs. Paine and Dalton were appointed a committee to correspond with electric light companies.

Meridian, Miss.—The Electric & Mfg Co. proposes to put in a 75-light arc plant complete, with two dynamos, lamps, 3 miles of wire, poles and fixtures, high speed engine, boilers, power house, etc, for $10,893.

Coldwater, Mich.—The electric light plant was put in operation Sept. 5.

St. Paul, Minn.—The Lighting Committee has recommended that a contract be made with the St. Paul Gas Light Co. to put up 100 or more additional electric street lights at 57 cts. each per night.

Kirksville, Mo.—An electric light plant is contemplated.

Baker City, Ore.—A local company will put in an electric light plant.

Reno, Cal.—The Reno Electric Light Co. will put in a steam engine to drive its plant, its operations having been interfered with by low water in the Truckee river.

Laredo, Tex.—The Electric Light & Power Co. has received a large amount of machinery, and will double the present capacity of its plant.

Special Reports of Water-Works Construction.

THE ENGINEERING NEWS MANUAL OF AMERICAN WATER-WORKS is now being compiled, and will be *indispensable* to every manufacturer, engineer and contractor in any way interested in Water-Works construction and maintenance, and will be of great value to Water-Works superintendents and projectors of new works.

Superintendents of water-works and water companies will wish to see correct and complete data concerning their Works in our MANUAL, and to ensure this they should send in reports *at once* upon the blanks which we have already sent to every Water-Works office in the United States and Canada. Many have delayed their report, and if the blanks we intended for them have been lost in the mail, or mislaid, we will send more upon request.

We *must* have a report from every public water supply system in North America, so those who reply to our inquiries at once will save a second inquiry. We also wish to know of *every* new Water-Works plant in process of construction, and of *every* new project in this line. We will send to any one desiring them, blanks upon which reports can be made.

Further details of the MANUAL will be advertised later. We abstract from our special reports for the MANUAL the following items of current interest:

LAKE VIEW, Ill., Sept. 7, 1887.

EDITOR ENGINEERING NEWS: We have outgrown our inlet capacity of 8,000,000 galls. per 24 hours and our machinery capacity of 10,000,000 galls per 24 hours, as afforded by a Corliss, Worthington and Flander's pump, and 16 and 20-inch pipes reaching out 1,700 and 2,000 ft. respectively, into Lake Michigan, and have just completed the putting in of a Holly pump of 12,000,000 galls. capacity for 24 hours. We are also contemplating the extending of a 26-inch pipe (now laid as far as the shore, to be used in emergencies such as fires, etc.) farther out into the lake, 1,000 ft., more or less, to give us increased supply, enough to last until we can build a tunnel or some other device which will afford adequate supply for all time to come. H. C. LEACH, *City Engineer.*

Wakefield Water Co.
68 WALL ST., NEW YORK, Aug. 29, 1888.

EDITOR ENGINEERING NEWS:—The particulars appearing in your last issue, page 158, respecting this company and its operations are inaccurate. Any information desired for insertion in your manual will be gladly furnished at the office. Yours respectfully,
RICHARD PANCOAST, *President.*

The above letter refers to a communication in our issue of Aug. 25, p. 158. We have forwarded to the Wakefield Water Co. a blank for fuller information but beyond the above statement can obtain no further details at present

ONTARIO, Cal., Aug. 29, 1888.

EDITOR ENGINEERING NEWS: I am in receipt of your favor of July 9th, and have handed it for particular reply to our Engineer, Mr. F. E. Trask, who can give you a great amount of detail exemplifying our scheme which I cannot. Ours is rather an irrigating system, than town, yet it combines both. The town covers 160 acres for which 16 miners inches have been allotted for domestic supply. Outside of this the irrigating system is designed to cover about 10,000 acres. The water is conducted in cement pipes, underground, to the highest point on each 10 acres. The town supply is taken from the pipe coming down Euclid (the central avenue) Avenue of the Colony. It is taken into iron mains 2¼ miles north, which gives a constant supply and a good pressure. The water is developed and pipes laid by the Land Co., and each year it is measured and deeded by Land Co. to the Water Co., receiving therefor 10 shares of stock for each inch of water. This stock is by them deeded to the purchasers of land, so the only stock issued by the Water Co. goes to the land owners, and is issued from time to time as water is developed and land sold. Thus you will see the Land Co. can only sell land as they have water stock to go with it and when they run short they must develop more water, which is done (1st) by improving the natural flow in the stream by clearing up the streams and springs so as to decrease evaporation; (2d) by tunnelling for the subterranean flow. In California more water runs beneath the bed of streams than is found flowing in them, and this is brought to the surface by means of tunnels; (3d) by artesian wells.

I cannot give you the separate items of cost of the domestic and irrigating systems. Our 80 miles of cement and iron pipes have cost a little over $200,000. As it is one of the best, if not the best and most perfect system in California. I know you will be interested in learning more about it and for this reason I have asked our engineer to give you as full details as possible.

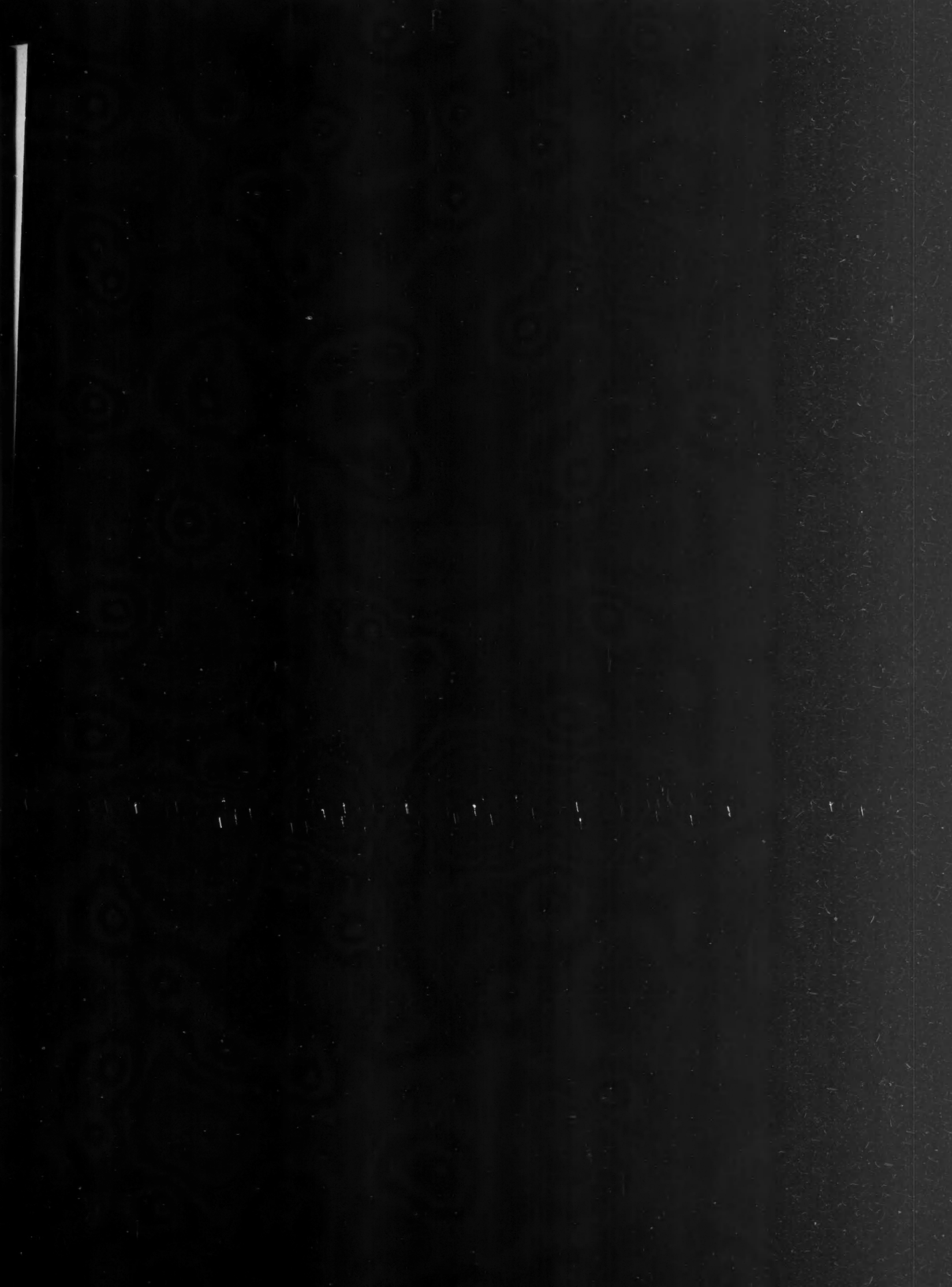
C. FRANKISH.

RECORD OF NEW WATER-WORKS CONSTRUCTION.

(Specially Communicated.)

CONTINUED FROM PAGE 198.

Holmesburg, Pa.—The works were commenced in October, 1887, and were to be completed in July, 1888; at the time of our special report, (February 13, 1888), some pipe had been laid and work had been started on the stand-pipe. They were designed by ISAAC S. CASSIN, of Philadelphia, Pa., who was also Constructing Engineer. The contractors were as follows: for masonry, foundations and buildings, Wm. Pyle, Wilmington, Del.; for pumping machinery, Holly Manufacturing Co., Lockport, N. Y.; for pipe and specials, Warren Foundry Co., New York; for trenching and pipe laying, John B. Foley, Philadelphia; for valves and hydrants, Union Works, Philadelphia; for reservoir and stand-pipe, S. B. Farmer, Harrisburg, Pa. The supply is drawn from Sandy Run and pumped to a stand-pipe by a Holly engine with a daily capacity of 1,000,000 galls. The reservoir has a capacity of 1,500,000 galls., and the stand-pipe 100,000 galls. There are about 5 miles of 8 and 10-in. cast-iron pipe; the services are 6 and 4 ins. diameter. Cost of works, $40,000; rate of interest, 4 per cent. The hydrant rates are the same as in Philadelphia. The works are owned by the Holmesburg Water Co.; President, WM. B. BUNKER; Secretary, A. C. SHALLCROSS; Treasurer, J. ROWLAND. The capital stock is $30,000; no bonds. The present population is 2,000

Defiance O.—The works were commenced Oct. 17, 1887, and were to be completed by Sept. 1, 1888. They were designed by ELLIS MORRISON, of New York, who was also Constructing Engineer. The contract for construction was awarded to Samuel R. Bullock, of New York; the pipe and specials were furnished by Dennis Long & Co., of Louisville, Ky.; and the valves and hydrants by the Ludlow Valve Mfg. Co., of Troy, N. Y. The Maumee river is the source of supply and the water is pumped to a stand-pipe 22 ft. diameter and 140 ft. high, by two compound, condensing pumping engines with a daily capacity of 4,000,000 galls. There are 12.8 miles of pipe, and 130 hydrants; the mains are of cast-iron and the service pipes of wrought-iron and lead. Annual revenue from the city, $5,200. The franchise is for 30 years, and the hydrant rental is $40 per hydrant per annum. The works are owned by the Defiance Water Co.; President, DENTON W. DURYEA; Secretary and Treasurer E. F. FULLER. Capital stock, $200,000; bonds, $200,000. The present population is 8,500.

(TO BE CONTINUED).